JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE

State of Pennsylvania

AND

AMERICAN REPERTORY.

MARCH, 1844.

Civil Engineering.

Major Parlby's Breakwater.

The Society of Arts have voted to Major Parlby, a silver medal, for a plan of forming breakwaters, of which the following description has been sent us:—

The principle of this breakwater is taken from what may be observed in every part of the world, viz., the effects of reeds in rivers and lakes, and of sea-weed in the ocean, in calming, or subduing, the turbulence of the swell of waves. Now, there is a fucus, or marine, plant, common in the seas about the Cape of Good Hope, which grows in a long tubular form, from twenty to thirty feet in length; at one end—that which floats upon the surface of the sea—it has a trumpet formed termination, while the other attaches itself to rocks at the bottom of the sea. This has served as a kind of model to Major Parlby for the construction of the component parts of his breakwater, which is, indeed, merely planting a complete bank of artificial gigantic reeds in the middle of the sea. Major Parlby's first idea was the employment of a considerable number of spars, such as those used for scaffolding, enlarging one end, and adding cork to make them more buoyant, and attaching the other end by a piece of chain, or rope, to the bottom of the sea, by means of ballast, cast-iron framings, or other practical means, and placing these spars about three feet from each other from centre to centre, and from fifty to eighty in depth; but an intelligent gentleman having suggested the employment of India rubber, (a very happy idea,) Major Parlby purposes now to form the breakwater by pieces of the coir rope of India, which is itsel exceedingly buoyant, and almost imperishable in salt water, and coat-

ing and forming the reeds, or floating trumpets, with India rubber, so as, in some degree, to resemble the very weed itself. A more happy, or a more practical plan of forming a breakwater can hardly be conceived, as they can be of every form, shape, and size, and have this peculiar advantage over all breakwaters that have yet been proposed, that they do not interfere with the sea way, but a vessel can sail through them, without injury, in every direction, and thus no particular entrance to a harbor is required, but vessels can enter whatever the wind and tide may be. The application of this breakwater, Major Parlby remarks, may be found of great service for the following purposes: For protecting roads for shipping, harbors, piers, landing places, &c. For forming harbors of refuge in the open sea for ships, coasters, and fishing boats, wherever it is desirable, where good anchoring ground can be found. For preserving the coasts of the sea, and thus much valuable property from annual dilapidation and loss, by the falling of cliffs, the washing away of land, and from the effects of the violence of the waves. For breaking and calming the sea on all the sloping sandy shores where bathing machines are in use, so as to prevent the dangerous and injurious effects of breakers on the shore.

Practical men, who will immediately begin to inquire into the cost of breakwaters of this description, may be guided in their estimate by the calculation of the number of floating reeds, or trumpets, required, placed at three feet apart, and fifty feet in breadth; a breakwater of extent equal to that at Plymouth, which is about 1700 yards, or nearly a mile, will require $1700 \times 50 = 85{,}000$; the cost of these will, of course, depend upon the depth of the sea, as the trumpets must be long enough to reach from the bottom to the top of the water at the highest tide; and, as far as calculations have at present been made, the expense of the coir and India rubber trumpets, with the cast-iron gratings and ballast to fix them securely at the bottom of the sea, may be about 2*l.* each trumpet—consequently, the expense of a breakwater on this principle, equal to that at Plymouth, would be 160,000*l.*—a very small sum compared with the expense of that magnificent work, which, however valuable as a protection to the harbor in severe gales of wind, has, in consequence of its unyielding materials, been the cause of the loss of several vessels; and as large open sea-ways are obliged to be left at each end of the breakwater, the swell and turbulence of the sea enters with great violence at times, rendering the passage in and out extremely dangerous. The breakwater, on Major Parlby's principle, may stretch completely across a channel from shore to shore, without offering much impediment to the sea way—and certainly no dangerous one. It is also capable of being removed at any time, without any considerable expense; a thing impossible to be done with stone breakwaters.

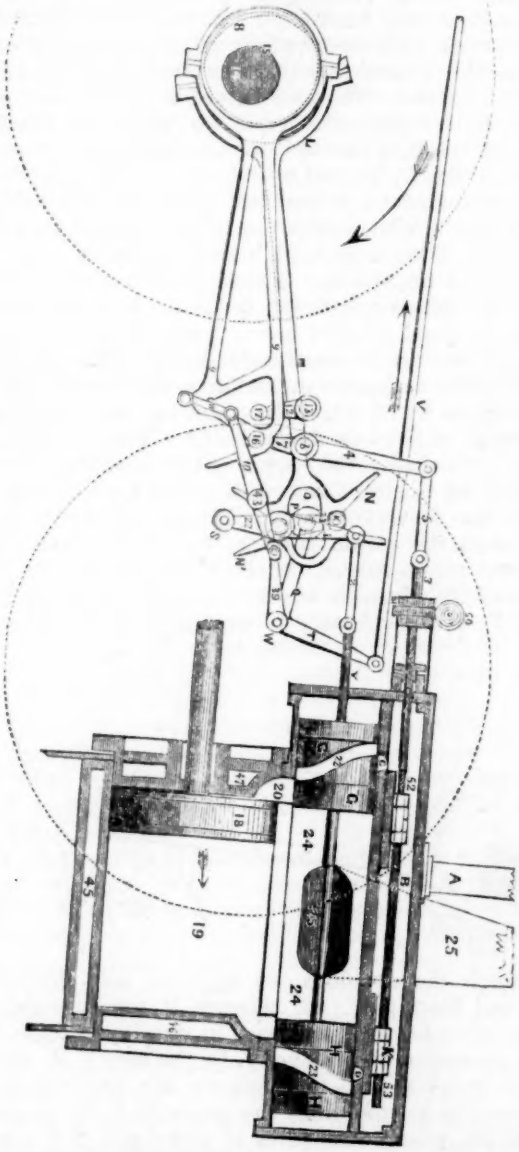
Lond. Mech. Mag.

Parsons' Locomotive Expansive Apparatus.

Fig. 1, represents a section of one of a pair of locomotive cylinders,

with its valve, and an elevation of the necessary gearing for working the steam and expansion valves. Fig. 2, is an elevation of the gear-

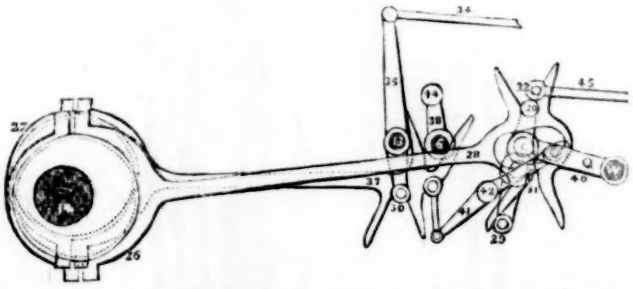
Fig. 1.



ing for working the valves of the second cylinder. The cylinders are provided, in the usual way, with pistons, piston-rods, and connecting

rods, for the purpose of communicating the power of the steam to two cranks at right angles to each other on the same shaft, or axle, to which the driving wheels of the engine are attached. The steam from the boiler enters through the pipe, A, into the valve-box, B, which box contains two flat sliding valves, I and K, attached to the same rod, 3, for the purpose of cutting off the communication between the boiler and the cylinder, so that the steam may act on the piston by its expansive force. The two valves, I and K, have nuts let into them, one with a right-handed, and the other a left-handed thread, into which the rod, 3, is screwed, so that when it is turned, by means of the endless screw, 50, and wheel, 51, the distance between the valves is either increased, or lessened, according to the degree of expansion required. At the end of the rod on which is fixed the endless screw, 50, a fine thead is cut, with a traveling index, which shows the precise amount of expansion. The rod, 3, is connected to the lever, 4, by means of another rod, 5, and the lever, 4, is attached to a shaft, 6, on which is fixed another lever, 7, which receives motion from the eccentric, 8, through the eccentric rod, 9 9. The eccentric rod, 9 9, can be made either to impart its motion to the lever, 7, as represented in the drawing, or by raising it by the lever, 10, and link, 11, to the lever, 12, which is fixed on the shaft, 13. The eccentric, 8, is fixed on the main crank-shaft of the engine in such a position that its centre, 15, may make an angle of 45° with a line drawn from the centre of either of the pins, 16 or 17, through the centre of the main shaft, 14, when the piston is at the top of its stroke. C to G, and H H, are two piston-valves, connected by the rod, X, having passages, 22 and 23, through which the steam passes from the openings, C and D, and alternately to each side of the piston, 18, and

Fig. 2.



thence through the openings, 20 and 21, into the eduction passage, 24, and blast pipe, 25, whence it finally escapes into the atmosphere, after having performed its duty in the cylinder. These valves are connected to the lever 1, by the rods Y Z, which lever is fixed on the weigh-shaft 2, to which are also fixed two levers, 22 and 23, which receive motion from the eccentric L, by means of the eccentric rod M, which terminates in two forks, N N^1, and a slot, O. The eccentric L, is fixed on the crank-shaft, 14, at an angle of 90°, with a line drawn from the centre of the crank-shaft 14, to the centre of the weigh-shaft 2, when the piston is at the top of its stroke. The

forks of N N^1, serve to guide the pins R and S, into their respective notches in the usual way, when the engine is reversed, or the contrary. A roller, P, is placed in the slot O, and turns freely on a pin at the end of the lever Q, which supports the weight of the eccentric rod M, and shifts it either on to the pin R, or the pin S, according to which way the engine is required to move. This lever, Q, is fixed on the lifting shaft W, which receives its motion from the lever T, connected by the rod U, to the reversing lever, which is under the control of the driver. The gear for working the valves of the second cylinder, represented in fig. 2, differs but little from the gear employed to work the other. The eccentrics 26 and 27, are placed in a similar position as the eccentrics 8 and L, before described, and the eccentric rod 28, is similar, in every respect, to the eccentric rod M, and communicates its motion to two levers, 29 and 30, on the weigh-shaft 31, to which the lever 32, is fixed, which gives motion to the slides, similar to G and H, fig. 1, through the rod 45, in the same way as before described.

The rod 3, which is fixed to slides similar to I K, in fig. 1, receives its motion from a lever, 35, fixed on the weigh-shaft 13, on which is another lever, 36, to which the eccentric 27, gives its motion through the rod 37. The eccentric rod 37, can also be made to impart its motion to the lever 38, on the shaft 6, by lifting it up, the fork 47, guiding the pin 44, into the notch provided for it. The levers, rods, &c., are shown in such a position as to make the cranks and shaft revolve in the direction shown by the arrows. But when it is required to reverse the motion of the engines, the rod U, is moved by means of the reversing lever V, in the direction indicated by the arrow, causing the lever T, to turn the shaft W, on its centre. The motion thus communicated to W, passes down the levers Q, 39 and 40. The lever Q, causes the rods M and 28, to move off the respective pins, R and 30, on to the pins S and 29, thereby reversing the steam-slides G and H, and similar ones in the other cylinder. At the same time the small levers 39 and 40, cause the levers 10 and 41, to move about their respective centres, 43 and 42, and thereby the eccentric rods 9 9, and 37, to move off the pins 16 and 36, on to the pins 17 and 44. It will be seen that by this arrangement the eccentric 8, will work the expansion-slides of the opposite engine, and *vice versa*, thereby reversing the expansive-slides of each cylinder. The valves I and K, may be made either in one piece, or two; but Mr. Parsons prefers making them in two, for the purpose of adjusting the expansion to any required degree. To keep the steam warm during its action in the cylinder, he uses a jacket, 45, and allows the steam from the boiler to have free access to the space between it and the cylinder, and likewise to the spaces 46 and 47, at the top and bottom of the cylinder. Mr. Parsons recommends that the whole of the jackets and steam spaces shall be well clothed with felt.

The description given in the specification of this arrangement, for working and reversing the expansive valves, concludes with a valuable suggestion: "It may be applied," says Mr. Parsons, "to work the ordinary valves of locomotive engines, when the lead of the

eccentrics amounts to an angle of 45°, whereby two of the four eccentrics, now generally employed, may be dispensed with."

The metallic packing for the pistons and valves is constructed in a novel and very ingenious manner: two split rings made of any two metals, such as wrought and cast-iron, which expand unequally under equal increments of temperature, are riveted, or otherwise firmly secured together, the most expansive metal being placed innermost. The splits in the two rings do not correspond, but are made at a short distance from each other, so that the inner ring shall extend behind a tongue, which is accurately fitted into the outside ring, by which means the steam is prevented from passing through the splits when the rings become heated by the steam. The inner one expanding more than the outer, they have a natural tendency to open, or buckle outwards, and press against the cylinder without the aid of springs; and this property they will retain until the outside ring is completely worn away. The pressure too must always be in proportion to the temperature, and, consequently, the pressure of the steam. In the valves, the outside ring is made to lap over the edges of the piston frames, which, consequently, do not interfere with the passages.

Ibid.

On working Locomotive Engines Expansively, and the applicability to the purpose of Parsons' Patent Expansive Apparatus. By Messrs. Parsons and Bunning, Civ. Engs.

Many attempts have been made to effect a saving of fuel in locomotives, by working the engines more expansively than is now the practice, but experience has seemingly proved that no advantages are gained by making the steam expand more than one-fourth of the stroke. Many engineers have attributed the failure to the rapid rate the engines travel at, which, they think, does not allow time for the steam to expand. But this reason cannot hold good; for when the steam is once admitted into the cylinder, cut off and confined there, were it not to expand, it must be at a greater pressure near the cover of the cylinder, than near the piston, which is manifestly absurd. Doubtless, however, there is a loss which a common unexpansive engine is liable to, from the great velocity of its piston: for when the crank is going over its centres, the piston has scarcely any motion, and the steam has time to pass through the openings, and attain a pressure nearly equal to that in the boiler. But the very great velocity of the piston, when at half-stroke, considerably reduces the pressure in the cylinder, which, however, is again increased as the piston loses its velocity, so that the whole cylinder, full of 50 lb. steam, is used, while an average pressure of perhaps from 40 to 45 lbs. only is rendered available. This is manifestly occasioned by the openings into the cylinder being too small to supply steam, when the piston is moving at its greatest velocity. But this loss will not attend an engine in which the steam is cut off before the piston has attained that

greatest velocity; for the steam, once in the cylinder, cannot be throttled, it is a mechanical impossibility that it should not expand.

The great drawback, however, to expansion with the common slides, is most probably the loss of power occasioned by closing the eduction opening too soon, and thereby compressing the steam that remains in the cylinder; for, suppose the steam is cut off at half stroke, admitted precisely as the piston is at one end of the stroke, and allowed to pass into the atmosphere at the moment it arrives at the other, then it is evident that the eduction port will be closed, and the communication with the atmosphere cut off at half-stroke. Now, although this does not seem a very great evil at first sight, as the steam is supposed to have been already got rid of, yet it is a source of a most serious loss of power. For the back pressure on a locomotive, owing to the diminished size of the blast-pipe, is certainly not less than 5 lbs. per inch, and the pressure of the atmosphere being 15 lbs., makes a total pressure resisting the force of the steam equal to 20 lbs. per inch, at the time the communication with the atmosphere is shut off. Let us suppose, therefore, that the cylinder has a 20-inch stroke; the back pressure being, as we have shown, 20 lbs., when the piston has traveled 10 inches, and, consequently, when it has moved another 5 in. the pressure will be increased to 10 in. of 20 lb. steam, compressed into 5 in., which would be equal to 40 lbs.; and at the end of the stroke it will equal 5 in. of 40 lbs. steam, compressed into the clearance, say half an inch, or not less than 400 lbs. upon the inch; but when the total pressure of this steam on the face of the valve which covers the opening, exceeds that on the back, it lifts the valve, and allows the steam from the boiler a free communication with the atmosphere. This, then, is the reason of the non-success of expansion, when carried to any considerable extent with the common valve, and not, as supposed by some, because the steam has not sufficient time to expand.

It is usual with the best engine makers to allow the steam to pass into the atmosphere, a little before the piston has arrived at the end of its stroke, and it is undoubtedly advantageous to do so, as by that means the eduction port is well opened by the time the piston begins to return; but if this is carried too far, there is a loss of power, as the steam is thrown away before it has given out the whole of its force.

Expansion with the common slide, (to be attended with beneficial results,) is, therefore, limited; for if carried beyond a certain extent. the loss, from throwing away the steam before the piston has arrived at the end of its stroke, and from compressing it in the cylinder more than counterbalances the benefits derived from the increased expansion. It, therefore, becomes a nice point to settle how to obtain the greatest quantity of expansion without diminishing the power of the engine. Experience and the practice of the most celebrated makers have proved, that the best and most economical point at which to cut off the steam with the common slide, is at about three-fourths of the stroke of the piston. If carried beyond this, the evils above enumerated, begin to manifest themselves; but in our patent engines, with our patent apparatus, the steam may be cut off *at any part of the*

stroke at the pleasure of the driver; it may be altered too while running, and it is admitted, or cut off, when the piston has scarce any velocity, while the eduction steam has a free communication with the atmosphere during the whole of the stroke.

The following table shows the relative consumption of steam of two engines of equal power, one on the most approved common construction, cutting off at 14 inches, and one on our patent principle, cutting off at 4 inches of the stroke of the piston.

TABLE.

	Cylinders.		Length of stroke in inches.	Distance the piston has traveled when the steam is cut off, in inches.	Press'e of the steam in the boiler in lbs. per square inch.	Mean press'e on the piston in lbs. per square inch.	Total mean pressure on the piston in pounds.	Quantity of steam used at a single stroke in cubic inches.
	Diameter in inches.	Area in square inches.						
Common engine,	12	113	18	14	55	52.7	5955.	1582
Patent engine,	17⅞	249.5	18	4	55	23.87	5955.5	998

It will thus be seen that our patent engine, when cutting off at 4 inches, as in the table, will be fully equal in power to an ordinary 12 inch engine; but its power can be increased to a very great extent, by admitting a greater charge of steam. It can also be lessened to suit the load and the gradients. It will be further observable, that the quantities of steam used are in the proportion of 1582 to 998; or taking the quantity used by the common engine as 100, that used by the patent engine will be 63, which is equal to a saving of 37 per cent. from expansion alone. Besides, the pressure on the piston of the common engine is here taken, as if it were of the same pressure as that in the boiler until cut off; but, for the reasons before stated, this is unlikely to be the case.

As the table exhibits so great a saving in steam, it would be natural to suppose that much smaller boilers would be sufficient to produce it; but we would recommend that boilers of the ordinary size, or nearly so, in proportion to the power of the engine, should be employed, and that the blast-pipe should be considerably increased in size, thereby diminishing the force of the blast, the back pressure, and the rapidity of combustion.

The advantages which we expect to result from the adoption of our expansive apparatus are these:—

1st. A great saving in fuel and water, arising from three causes; first, from using the steam expansively, to the extent, and in the manner proposed, as shown in the table; 2nd, from the slower combustion; and 3rd, from the diminished back pressure.

2nd. The increased durability of the fire-box and tubes, consequent on the slower combustion, and diminished blast.

3rd. The ability to increase, or diminish, the power of the engine,

without stopping to adapt it to the different gradients, and to the different weights to be drawn.

4th. Having at command more than double the power of the engine when suddenly reversing to prevent a collision, on account of the increased area of the cylinders.

5th. The number of engines on a railway may be considerably lessened; and it will not be necessary to have engines constantly in attendance at the foot of steep inclines, to assist the trains.

6th. The number of water cranes and stationary pumping engines may be considerably diminished, as the same quantity of water will supply an engine for double the distance.

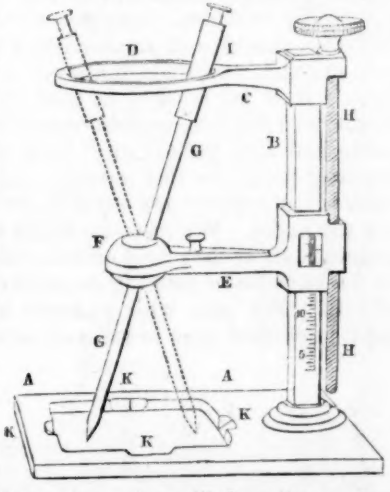
7th. The danger of setting fire to property adjoining the line, from red hot ashes, driven out of the chimney by the blast, will be done away with, as the power of the blast will be considerably reduced.

We hope that the above remarks will serve to show that steam cannot be used expansively, to any great extent, with the common valve; but, that, by means of our patent gear, the expansive system may be carried out to a very great extent, in locomotive engines, and the cost of working railways be proportionally reduced.

Ibid.

Elliptograph, a new Drawing Instrument, by JOHN HICK, Jr., *of Bolton, Lancashire.*

The annexed figure represents the Elliptograph, a model of which is in the Society's Repository, since depositing which, however, Mr. Hick has substituted a universal joint, or centre, for the ball and socket joint, F, shown in the figure, and when drawing in isometrical perspective, he removes the flat part, I, allowing the pencil, or pen-holder, itself to be in contact with the inner rim of the elliptic gauge, D. On the base plate, A, is fixed an upright bar, or standard, B, to the top of which is attached the projecting arm, C, carrying an elliptic ring, D, below which, on the same standard, is another projecting arm, E, provided at the end with a ball and socket joint, F, which forms the centre of motion for the pencil, or pen-holder, G, passed through it. The arm, E, can be raised, or lowered, at pleasure, by means of the screw, H.



By passing the upper end of the pencil-holder round the inside, and in contact with the gauge ellipse, the point will describe on the

paper laid beneath the stand, A A, an ellipse of the same proportions as the gauge above, and of other required sizes, by raising, or lowering, the arm, E.

The holder has a flattened part at I, which, in moving round, must always be kept against the edge of the gauge, in order to preserve the pen in its right position for drawing.

In the instrument, as shown in the figure, only one proportion of ellipse can be described; but as it is that generally required, (and entirely so for isometrical drawing,) but little alteration is required to make it generally useful.

A few gauge ellipses of various proportions may easily be substituted for that at present attached to the instrument.

The standard, B, is graduated on two sides, so as to describe on paper an ellipse of relative transverse and conjugate diameters, one side corresponding with the major, and the other with the minor axis of the ellipse, and by means of the centre lines, K K K K, the instrument may be accurately set in the required proportion on the paper.

Trans. Soc. Arts, Manuf. & Com.

Manumotive Railway Carriage.

We are informed that a machine of this description is in use upon the London and Croydon Railway, having been lately made for Mr. Gregory, the resident engineer, by Mr. George England, engineer, well known as the inventor of the patent traversing screw jack, and other important improvements. The machine is light and elegant in appearance, and will carry seven or eight persons at the rate of eighteen miles an hour. It was propelled on Monday last by Mr. Roberts, deputy chairman of the Croydon Company, and Mr. England, the inventor, from the New Cross station to the Dartmouth Arms—a distance of three miles up an incline of 1 in 100, in seventeen minutes, and upon the level line at the rate of twenty miles an hour. It is intended to be used by Mr. Gregory, and his assistants, to traverse the line, inspecting any repairs, or other works, going on connected with the railway; and will, in our opinion, be found particularly useful for this purpose, and more especially so in connexion, with those works upon the line which it is necessary to carry on during the night. We have no doubt that these machines will come into general use, as they will effect a considerable saving to the company, in the expense of running an engine for the purposes which they will supply. We hail with pleasure anything calculated to reduce that most important item in railway accounts—the locomotive expenses.

Lond. Railway Times.

Royal Steam Navy—Parliamentary Returns of Cost of Engines, Makers' Names, Expenditures for Repairs, &c.

A Return of the original Cost of the Engines of the following Steam Vessels, specifying any extra charge beyond Contract price, and if such vessels were fitted with an Indicator; of Repairs, and of the cost of such repairs, and the number of days and hours any of said vessels were incapable of performing their work, in consequence of such repairs; and of the names of the makers of each of the engines of said vessels:

Names of Vessels.	Original Cost of Engines.	Extra Charge beyond Contract price.	Indicator.	Repairs.			Cost of Repairs.			No. of days and hours the vessels were incapable of performing their work, in consequence of such repairs.	Names of the Makers of the Engines.
				Nature.	Period over which they extend.						
					From	To					
	£	£					£	s.	d.		
Alecto,	10,700	297	not fitted.	two engines boilers and paddle-wheels.	13 Jan. 1840	31 Mar 1843	1,158	4	4¾	393	Messrs. Seaward & Capel.
Devastation,	18,650	681	do.	do.	Dec. 1841	do.	249	10	8½	92	Messrs. Maudslay, Son & Field.
Geyser,	13,933	440	do.	do.	July 1842	do.	89	7	3½	50	" Seaward & Capel.
Cyclops,	22,103	906	do.	do.	Oct. 1840	do.	800	7	10	164	do. do.
Prometheus,	10,700	315	do.	do.	March 1840	do.	1,012	1	5½	353	do. do.
Polyphemus,	10,700	214	do.	do.	June 1841	do.	240	7	11½	162	do. do.
Vesuvius,	13,480	400	do.	do.	Oct. 1840	do.	37	19	0¼	38	Mr. Robert Napier.
Stromboli,	13,480	nil.	do.	do.	Sept. 1840	do.	68	6	3¼	51	do.

Admiralty, 26th May, 1843.

WILLIAM EDWARD PARRY,
Comptroller of Steam Machinery.

Mechanics, Physics, and Chemistry.

ENGLISH PATENTS.

Specification of a Patent granted to SAMUEL KIRK, ***of the county of Lancaster, for certain improvements in Machinery, or Apparatus, for preparing cotton and other fibrous substances for spinning. Sealed 31st January,*** 1843.

These improvements in machinery, or apparatus, for preparing cotton, and other fibrous substances, for spinning, consist in a novel arrangement and combination of mechanism, for the purpose of compressing the sliver, or web, of cotton, (as produced by the carding engine, and other preparation machinery,) or other fibrous substance, into cans, or suitable receptacles, in order to form the same into coils, containing a much greater quantity, or weight, of cotton, or other fibrous substances than hitherto produced, and, consequently, lessen the number of piecings, producing thereby a more even sliver, and also to lessen the amount of labor usually employed in the preparation processes.

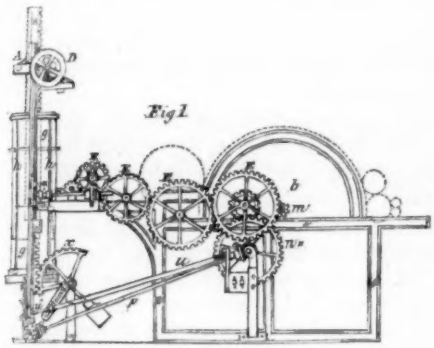
The practical spinner, will, doubtless, be aware that the sliver, or web, of cotton has, in some manufactories, been hitherto slightly pressed into the common small cans, and on, or into, other receptacles now ordinarily used to receive the web as it is produced by the carding engine, either occasionally by the hand of the attendant, or by a mechanical contrivance.

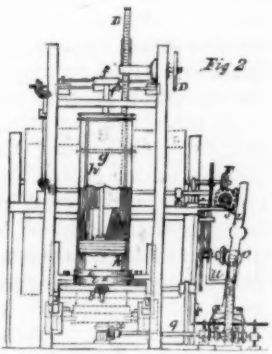
The object of the present invention is to effect this operation in a greatly extended degree; to employ cans, or other receptacles, of increased diameter, or size; and to compress the web, or sliver, into a firm and compact body, or to form a continuous coil, as hard as the fibres will allow, and, consequently, effect a great economy in the number of cans, or other receptacles, as also in the bobbins, commonly used; as these said coils of slivers, or webs, may be doubled in any degree, or number, and similarly pressed, in connexion with the drawing, slubbing, and roving machines, and so afterwards be taken direct to the spinning frames, entirely without the use of bobbins, if so preferred.

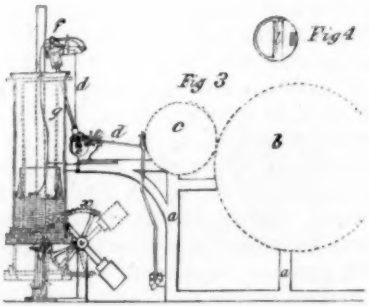
The drawings represent the improved combination of mechanism, as applied to an ordinary carding engine for carding cotton; and as the further application to the various operations, during the preparation process, will be evident to the practical spinner, a description of them, with reference to the drawing, slubbing, and roving machines, is considered unnecessary.

Fig. 1, represents, in side elevation, the improved pressing apparatus, as attached to the delivering, or doffing, end of the carding engine; fig. 2, is a front, or end elevation, shown partly in section; and fig. 3, a longitudinal section, taken vertically through the same. The frame of the carding engine is represented at *a*, *a*; the main cylinder at *b*, *b*; and the doffing cylinder at *c*; the web, or sliver, of cotton is shown at *d*, *d*, as proceeding through the drawing rollers, *e*, *e*, and

being conducted upwards through a pair of delivering rollers, *f*, *f*, from whence it passed into the can, or receptacle, *g*, *g*. This can is merely a tube, of about 12 or 14 inches in diameter, and about 4 feet long, open at both ends, and placed within a slight frame of upright rods, *h*, *h*, connected with the bottom, or bed plates, *i*, *i*, upon which it stands. The can, or receptacle, is caused to revolve slowly, as hereafter described, in order to coil the sliver, or web, therein; and after moving a certain portion of a revolution, it is made to ascend, and thus compress the sliver, or web, which has been collected into the can, between the bottom plate and a presser, or block, *k*, *k*, which is suspended in the can; and, as it meets the descending sliver, the danger of stretching the sliver, which, in the present plans, frequently happens, is thereby obviated. This presser, or block, *k*, is formed with an opening, *l*, fig. 4, through which the sliver, or web, *d*, *d*, passes downwards into the can.







The operation of the improved apparatus is as follows:—Supposing the can to be down, or in the position shown by dotted lines in figs. 2 and 3, and motion to be communicated to the shaft of the main cylinder, and the sliver, or web, *d*, passing from the carding engine, between the small delivering rollers, *f*, *f*, and through the slot, *l*, in the block *k*, into the can, or receptacle *g*, the pinion *m*, on the cylinder shaft, giving motion to the spur wheels *n*, *n**, the bevel

wheels *o*, *o*, and diagonal shaft *p*, will, by means of the mitre wheel *r*, on the cross-shaft *q*, being in gear with the other mitre wheel *s*, attached to the plate *i**, under the bottom plate *i*, (see fig. 3,) cause the can to revolve slowly, and bring that portion of the sliver *d*, which has just been delivered into the can, immediately beneath the solid part of the block *k*. A crank-pin, *t*, is fixed to the spur-wheel *n**, and is connected to the lever *u;* the other end of which lever will, at every revolution of the wheel *n**, strike the pin *v*, on the short lever *w*, and push it into the position shown in the drawing; and, by means of the segment-wheel *x*, on the shaft *y*, raise the rack *z*, and with it the bottom plates, supporting the can *g;* thus the can will be lifted into the position shown in the drawing, and the cotton, or other fibrous material, be closely compressed between the bottom plate *i*, and the pressing block *k*. The wheel *n**, still continuing to revolve, will then, by withdrawing the lever *u*, from the pin *v*, allow the can to descend by its own gravity, and the tail *u**, of the lever *u*, sliding along upon the pin *v*, it will thus be out of action, and allow the can again to revolve, by the mitre-wheel *s*, falling into gear with the mitre-wheel *r;* the can will thus again commence revolving, and the operation proceed as before described.

As the cotton, or other fibrous substance, accumulates in the can, and raises the block higher, the small ratchet A, fig. 1, falls into the notches in one side of the upright rack B, which supports the block *k*, remaining in the same notch until the accumulation requires another, and prevents the block from falling when the can descends; the small pinion C, which takes into the teeth on the other side of the rack B, being merely for the purpose of raising, or lowering, the block by hand, when necessary, by turning the hand-wheel D. As the revolution of the can imparts a slight degree of twist to the sliver, and as this is not in all instances desirable, a common reversing motion is represented in the drawing, which may be applied to the apparatus, and by causing the can to revolve alternately, in different directions, (say three times in one direction, and three in the reverse,) it keeps the sliver even and untwisted throughout. In order to drive this reversing motion, a train of spur-wheels, E, E, E, actuate the worm F, working into a worm-wheel, G, on the short shaft H; on the other end of this shaft, H, is a catch, I, which, acting alternately against one of the pins K, K, on the upper end of the lever L, will cause that lever to oscillate on its centre, and throw the mitre-wheels M, and N, alternately into gear with the wheel O, on the lower end of the diagonal shaft *p*. When the can, or receptacle, has become filled with the compressed sliver, or web, it may be lifted up and entirely withdrawn, leaving the coil of cotton on the bottom plate, and supported by the rods, or framing, *h*, *h*, which may thus be removed from the machine. Instead of using the rods *h*, *h*, outside the can, an upright spindle, connected to the bottom plate, may be placed inside the can, and the coil of cotton built around it, which will sufficiently support the coil when the outer can, or casting, is removed. It will be perfectly evident to the practical spinner, that a similar application of the improvement, as above described, in connexion with the carding engine, may

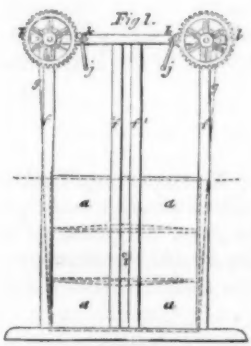
also be employed with the other machinery used for preparing cotton, or other fibrous material, for spinning, namely, the drawing, slubbing, and roving machines, in those instances where it is preferred to have the slivers of cotton, &c., made into coils, as first described, instead of being wound on to bobbins, as heretofore commonly practiced.

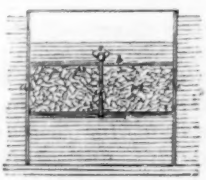
The patentee claims the peculiar combination, arrangement, and application of the machinery, or apparatus, above described, and exhibited in the drawings, to be used in connexion with the ordinary machines for preparing cotton, and other fibrous substances, for spinning, without confining himself to the present dimensions of apparatus for accomplishing, or effecting, the object above particularly described and set forth; that is, compressing the sliver, or web, into cans, or other receptacles, of a much larger diameter and length than commonly used, commencing the operation on the sliver at the bottom of the can, or receptacle, and proceeding upwards progressively, by self-acting means throughout.—[Enrolled in the Rolls Chapel Office, July, 1843.)

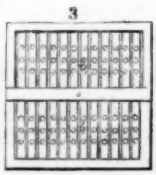
Lond. Journ. Arts & Sciences.

Specification of a Patent granted to WILLIAM HENRY STUCKEY, *of Guildford street, for certain improvements in Filtering Water and other Fluids. Sealed 3rd December,* 1842.

These improvements in filtering water and other fluids, are described as consisting in the employment of compressed sponge, as a filtering material, and in a method of cleansing the said compressed sponge.







An elevation of the filtering apparatus is represented in fig. 1, and a vertical section of the case, containing the filtering material, at fig. 2. The sponge is held in a compressed state in the case *a*, between the two plates *b*, *c*; these plates have a number of openings formed in them, as shown in fig. 3, which is a plan view of the plate *b*, and are connected together by the bolt *d*, and nut *e*. The case *a*, is suspended in a frame, *f*, by bands, *g*, *g*, which are wound upon the barrels *h*, *h*,

when it is required to be raised; and the case is guided, in its ascent and descent, by a pin, *i*, projecting from each side of it, and working between the upright rails f^1, f^1, of the frame. By turning the handles *j*, *j*, motion is communicated to the barrels *h*, *h*, through the pinions *k*, *k*, and wheels *l*, *l*; and the barrels are held in any required position by a ratchet-wheel and click, at the end of each.

When in operation, the filtering apparatus is placed in the water, or other fluid, to be filtered, and the case *a*, is lowered into it to the depth shown in fig. 2; the water will, consequently, ascend through the compressed sponge, until it arrives at the same level as the water outside of the case, and, by so doing, will be deprived of its impurities; it is then drawn off by a syphon, or any other suitable contrivance. If the water be of a very foul, or putrescent, description, a layer of charcoal may be placed between the pieces of sponge.

When the sponge requires cleansing, the case *a* is raised out of the water, by means of the bands *g*, *g*, and the clear water, which has collected above the sponge, rushes down through it, and carries off the greater portion of the impurities. Then, if the bottom of the sponge be not sufficiently cleansed, it is allowed to expand, in a slight degree, by raising the nut *e*; after which the case is turned upside down, by means of the bands *g*, *g*, and lowered into the water, to the depth shown in fig. 2; when the water, rushing up from below, through the sponge, will carry to the top most of the remaining impurities. The case *a*, being now turned over into its original position, the foul water, which has collected at the top, is poured into the cistern, or reservoir; the supply of water is then shut off, and the cistern is emptied of its contents, or the impurities are allowed to settle.

The claims made by the patentee, are, firstly, the employment of compressed sponge as the filtering material; and secondly, the means provided, as aforesaid, for cleansing the sponge, from time to time, without removing it from the machine.—[Enrolled in the Enrolment Office, June, 1843.] Ibid.

Specification of a Patent granted to THOMAS MITCHELL, *of Dalton, in the county of York, for a certain Machine and Apparatus for increasing and permanently fastening the face, or gloss, of all kinds of woolen, worsted, and fancy cloths, by the application of steam alone, without immersing the goods in water. Sealed June 15th,* 1843.

My invention relates, first, to a certain machine for winding woolen and worsted cloths, or fabrics, requiring heat in the finishing processes for laying the nap, or face, and obtaining a gloss, or finish, thereto; and secondly, to apparatus for applying steam to woolen and worsted cloths when rolled, in order more effectually and readily to set the face, and obtain a gloss thereto. And in order that my invention may be most fully understood, and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

Fig. 1, shows a side view in section of a machine for rolling cloths of wool, or worsted; and Fig. 2, is a front view thereof.

This machine is so arranged that the cloth, in its progress to be wound on a roller suitable for having heat applied thereto to set the face, or gloss, thereof, passes against one or two heated rollers. *a*, *a*, is the framing of the machine; *b*, is the hollow roller, on to which the cloth is wound, at the two ends of which there are square holes, and a square bar, *c*, is passed through the cylinder, one end of which passes into the square socket, *d*, and the other end of the bar has a cylindrical neck which moves in a bearing at the other

Fig. 1.

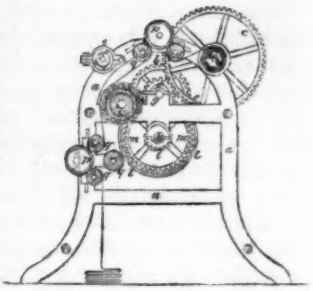
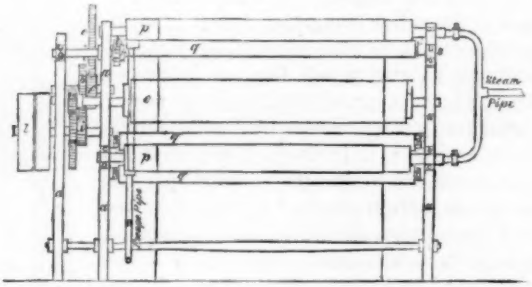


Fig. 2.

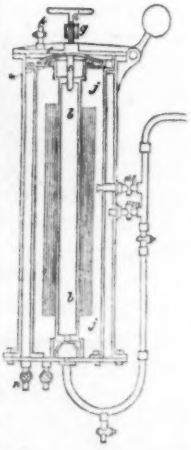


side, passing on the socket, *d*, which turns in a suitable bearing, on which is affixed the cog-wheel, *e*, which receives motion from the cog-wheel, *f*, affixed on the axis, *g*. On the axis, *g*, is a cog-wheel, *h*, which is driven by the cog-wheel, *i*, affixed on the main axis, *k*, which main axis is driven by a shaft acting on the pulley, *l*. On the main axis, *k*, is affixed the cog-wheel, *m*, which takes into and drives the cog-wheel, *n*, on the axis of the brush cylinder, *o*, by which the nap of the cloth is laid, in its progress, to the roller, *b*. The cloth, in its passage to the roller, *b*, is subjected to the action of one or two steam, or heated, cylinders, *p*, *p*, over and against which the guide rollers, *q*, *q*, guide the cloth, as is indicated by the red line; and in case the cloth is to be heated, or smoothed, by only one heated cylinder, then, in place of the cloth passing against the lower heating roller, *p*, it is caused to pass over the third guide roller, q^1. In some cases it is required that the cloth should be wound off the roller, *b*, on to a similar roller, so as to cause the winding to be more tightly performed; in this case the cloth on the roller, *b*, is, by its square axis, introduced into the socket, *r*, the other cylindrical end of the bar being received by the bearing, *s*, when, another roller being placed at *b*, the cloth is re-wound, the other end first, and the degree of tightness of the winding is governed by the friction band, *t*, acting on the cylindrical collar, *v*, affixed in the socket, *r*.

I will now describe the second part of my invention, which relates to apparatus for applying steam to woolen and worsted fabrics when rolled. It has heretofore been common to apply hot water, and, in some cases, steam, to cloths, or fabrics, of wool, or worsted. Now, the object of this part of my invention is so to arrange apparatus, that steam may be applied, under pressure, to rolls of cloth enclosed in a suitable vessel, or apparatus, such apparatus being so formed as to allow of the atmospheric air being driven out thereof by the pressure of the steam, the peculiar feature of the invention being the use of steam above the atmospheric pressure, so that the vessel, or apparatus, may be rendered void of air by steam.

Fig. 3, is an external view. This apparatus is suitable for applying steam to woolen, or other, fabrics, whether the fabrics be introduced in the dry, or wet, state, in place of immersing such cloths in hot water, as heretofore practiced, and the rollers being hollow, allow the steam to be introduced into the interior of the roller. *b*, is the roller; at the upper end of the roller is a plug, which is withdrawn when the steam is first introduced into the interior of the roller; and when the air is driven therefrom, the plug, *e*, is introduced, and the cover, *f*, is closed, and the bar, *g*, passes under the catch, *h*, and then the screw, *i*, is screwed down on to the cover so as to cause the vessel to be closed air and steam tight; steam is then allowed to flow into the vessel, *j*, and thus drive off the air at the cock, *k*, which cock is then to be closed; and if the fabric has been introduced in the wet state, then I do not allow the steam to continue to flow into the vessel, *j*, after the air has been driven out, but close that cock, *l*, and open the cock, *m*, so that the external part of the apparatus will be kept full of steam, the air being first driven out by the steam at the cock, *n*, and in this state I retain the apparatus for from ten minutes to a quarter of an hour, the nature of the fabrics treated requiring a slight difference of time, which a little practice will enable a workman to judge of. If the roll of fabric has been introduced in a dry state, then I continue the supply of steam to the inner vessel during the same time, the outer vessel not then being required. The steam which I usually employ is of about 20 lbs. pressure on the square inch in the steam boiler, but I do not confine myself thereto so long as the steam passed into the closed apparatus offers a pressure to drive off the air therefrom, and render it void thereof. When worsted fabrics are being operated on, I can use the roller, or cylinder, *b*, as shown, or the same may be perforated all over with numerous small holes, as is now sometimes practiced with worsted fabrics, and which, when separately considered, forms no part of my invention. [Enrolled August 15th, 1843.

Fig. 3.



Ibid.

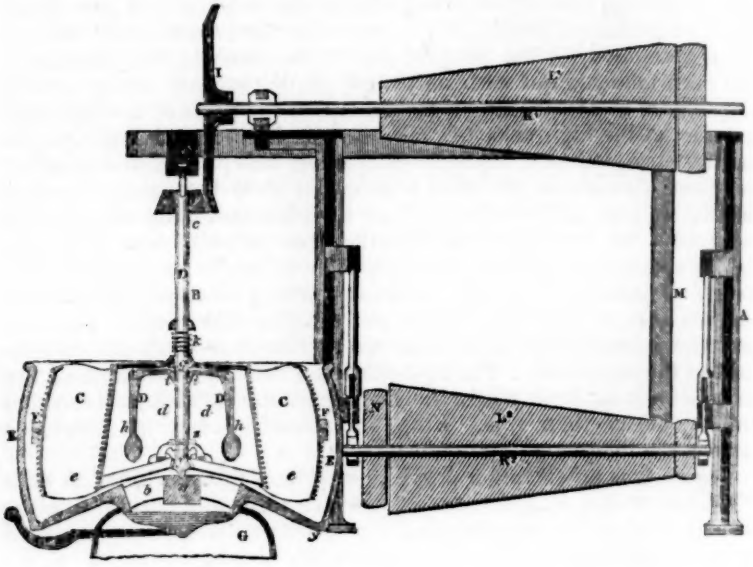
Specification of a Patent granted to Messrs. KEELY *and* ALLIOTT, *for a Drying Machine. Patent dated March* 2, 1843; *Specification enrolled September* 2, 1843.

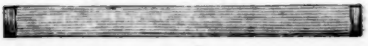
The idea of drying soft goods by causing them to revolve rapidly, and imparting thereby a strong centrifugal tendency to the liquid particles contained therein, is not new—for there have been two or three machines for the purpose before the present; but hitherto it has been followed out with only very partial success, owing to the difficulty of so constructing a machine, that the parts of it shall hold together at the high velocities necessary for drying goods rapidly. In one instance, where a machine of this sort was pushed to a speed of not more than about 300 turns a minute, a plate belonging to it flew off at a tangent, and cut the head of the attendant clean off. In the apparatus we have now to describe, this difficulty has, by a very happy combination of contrivances, been at length completely mastered. It is stated to be able to revolve with perfect safety at the rate of from 1500 to 2000 revolutions per minute, and such is the construction of the machine, that we see no reason to doubt the correctness of the statement. The inventor is a Prussian gentleman, of the name of Seyrig, from whom the English patentees, Messrs. Keely and Alliott, derive their title. From the specification of the latter, we extract the following description:—

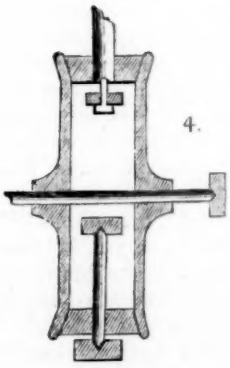
Figure 1, is an elevation partly in section of this machine; A A, is the frame work; B, a vertical shaft which turns in a socket, *a*, in the bottom bridge, *b*, and carries at top a friction cone, *c*, by which a rotary motion is given to it in a manner afterwards explained. C, is a drum of two concentric compartments, *d*, *e*, of the shape shown in the engraving, which is fitted loosely on the shaft, B, and rests, when not in motion, on two conical projections, *f*, *s*, turned on the shaft. Both compartments have one common bottom of metal, and are formed at the sides, each of a continuous length of tinned iron wire, wound in a series of circles at small distances apart, and connected transversely by slips of metal soldered thereto. The top, or cover, of the inner compartment, *d*, is secured by nuts and screws to a ring of angle iron, which binds the wire sides together at the top; but that of the outer compartment, *e*, in which alone the goods to be dried are placed, is made to lift off in order to introduce and remove the goods, and has a rim both on its outer end and inner periphery, so that when fixed in its place, the inner rim presses against the outside of the inner compartment, and the outer rim overlaps the sides of the outer compartment itself. When the machine is at work, the cover of the outer compartment is further secured in its place by bolts, or pins, (not seen in the engraving.) The sides of the inner compartment, *d*, are connected to the bottom by prolonging the transverse slips of metal which connect the circles of wire, and riveting, and soldering them to the plates. The wire sides of the outer compartment are bound together at top by a ring of angle iron, to which they are riveted and soldered, and are connected to the bottom plate by turning

up the plate over the sides, and soldering and riveting as before. D, is a governor suspended within the inner compartment, *d*, of the drum, C; the two weighted arms, *h*, *h*, being loosely affixed at their elbows

Fig. 1.







to studs in the top plate of the drum, so as to turn freely thereon, and resting by their upper ends on a ruff, *i*, projecting from the shaft. E, is an outer case which surrounds the whole of the drum, except at the top, and is intended for the reception of the water driven off from

the goods, but is fixed, not to the drum, but to the frame work, A A. At *y*, there is a tap for drawing off the water, and in the bottom an orifice for the insertion of a pipe to admit hot air. When a rotary motion is given to the vertical shaft B, it carries round with it the drum, and in proportion to the velocity of the motion, there is a centrifugal tendency imparted to the liquid particles contained in the goods, which is the useful effect desired to be produced by the machine; but as the same centrifugal tendency in the parts of the machine, would, in case of any unequal distribution of the weight, cause, if not counteracted, an injurious strain on the central shaft, B, and might cause at the high velocities necessary for drying goods quickly, an actual disruption of the machine, and as this difficulty is increased when the weight of the goods happens not to be quite equally distributed over the drum, the governor, D, has been introduced, in order to prevent such consequences. For, as the speed of the shaft increases, the arms of the governor expand, and gradually raise the drum C, from off its seat on the conical supports, *f*, *g*, and thus leave the drum free to adjust itself, according to its natural gravitating tendencies, so as to bring the centre of gravity in uniform coincidence with the centre of rotation. The drum is gimbled to the shaft in the manner shown in fig. 1, and allows of the drum moving in any direction. To prevent the drum from rising too suddenly, there is a spiral spring, *k*, affixed to the shaft immediately above the conical support, *g*. For still farther maintaining the drum in a state of equilibrium, it is encircled at the middle by a hollow ring, or girdle, F, of which a plan and section are given separately in figs. 2 and 3, which is about half filled with water, or other suitable fluid. As this ring rotates, should the goods weight incline to preponderate at any part, the weight of water getting to the opposite side serves, more, or less, to prevent and counteract such preponderance. The equilibrating effect of this ring is increased, if the interior is divided into two, or more, channels. G, is a pipe by which steam, or hot air, can be introduced into the centre of the drum, when it is desired, by these means, to accelerate the drying of the goods; the bottom of the drum being perforated at the centre with a number of holes to admit the same.

The rotary action of the shaft, B, is obtained in manner following: I, is a disk affixed to the end of a shaft, which disk is beveled off near to its periphery, to correspond at that part with the surface of the cone, *c*, at the top of the shaft, B, so that when made to revolve in a horizontal direction, it shall cause the cone, *c*, and shaft, B, to revolve in a vertical direction; L^1 is a cone affixed to the end of the shaft, K^1, and L^2, another cone of the same dimensions, but placed with its base opposite the apex of the other, which is affixed to a shaft, K^2, communicating immediately with the first mover, which may be either a steam engine, water-mill, or any other suitable machine. M, is the belt which connects the two cones, and by the unwinding of which from the larger end of one cone, upon the smaller end of the other, or *vice versa*, with the help of a guide in the known manner of working such alternate cones, motion is communicated to the shaft,

K[1], and retarded, or accelerated, or kept at one constant rate, according as may be desired. N, is the pulley to which the power of the engine is directly applied. Instead of one friction disk only (I) being made use of, two such disks may be employed if found needful, as shown in fig. 5, and having an additional friction cone at the top, the better to equalize the action of the rubbing parts; but in that case the additional disk and cone must turn loosely in their bearings.

At the Lenton Works, near Nottingham, Messrs. Keely and Alliott have a machine of this sort in operation, the drum of which is 36 inches in diameter, and which is worked usually at the rate of from 1500 to 1600 revolutions per minute. A machine of the same magnitude, on any other plan—that of Robinson, for example, patented three or four years ago—could not be worked with safety at half that speed. Besides this, Robinson's machine is so made that one of 36 inches diameter could not hold more than half the quantity of goods. which can be conveniently stowed away in one on the present improved system of construction.

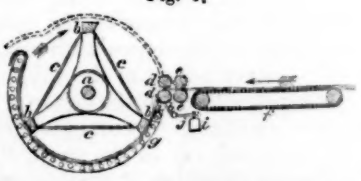
Lond. Mech. Mag.

Specification of a Patent granted to George Hickes, *of Huddersfield, in the county of York, for an Improved Machine for cleansing, or freeing, wool and other fibrous materials, of burs and other extraneous substances. Sealed 21st August,* 1841.

This improved cleaning machine contains four rotary beaters which act, in succession, upon the wool, or other fibrous material, for the purpose of removing the burs, or other extraneous matters that may have become mixed therewith.

Fig. 1, represents, in vertical section, one of the beaters, with its appendages. *a*, is the beater-shaft, carrying the three blades, *b*, *b*, *b*; (the patentee does not, however, confine himself to this number,) and *c*, *c*, *c*, are pieces of sheet-iron, or other suitable material, fastened between the blades, to prevent the wool from lapping round them; *d*, *e*, are two pairs of drawing-rollers, which receive the wool from an endless traveling cloth, *f*, and deliver it on to the curved grating, *g*; the upper roller of each pair being fluted, and the lower one plain. The lower roller of the second pair, *d*, is furnished with a straight edge, or doctor, *h*, which is held against it by means of a small weight, *i*, hung upon a tail-piece, *j*, projecting from the doctor; *k*, is a plate secured to the curved grating beneath the lower drawing roller, *d*, and on it the wool is beaten, or dressed, as it is delivered by the drawing-rollers.

Fig. 1.

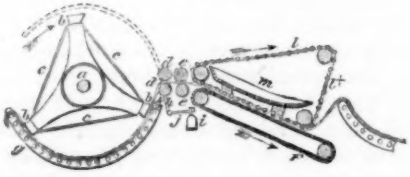


The action of the machine is as follows:—The wool, having been opened and spread upon the feeding-cloth, *f*, is carried by it to the

drawing-rollers; in passing through these rollers the wool is slightly drawn, and is then delivered to the action of the beater, by which it is carried along the curved grating to the feeding-cloth of the next beater. The wool is in this manner acted upon by all the beaters successively, and is delivered from the machine in a clean state.

Fig. 2, is a vertical section of a somewhat different arrangement for delivering the wool from one beater to another. It will be seen that the carrying-cloth, *f*, is in an inclined position, and a moving grate, *l*, is placed immediately over it. Against the upright side, l^*, of this moving grate, the wool is received when delivered from the beater behind it; the burs, &c., passing through the upright side, and falling into the tray, *m*, while the wool is drawn down by the motion of the grate, and carried forward between it and the feeding-cloth, *f*, to the drawing-rollers.

Fig. 2.



The patentee claims, firstly, the general construction and arrangement of the machine for cleaning wool, as regards the beaters being used in combination with a curved rack and drawing roller, as above described. Secondly, the particular construction of the beaters, as shown in the drawings, and the application of a doctor, as at *h*, and used in combination with a curved rack and drawing-rollers. Thirdly, the plate, *k*, on which the wool is dressed, or subjected to the action of the beaters. And fourthly, the moving grate, *l*, with its rollers and tray, on which the wool is thrown on leaving the beaters, as above described. [Enrolled in the Enrolment Office, February, 1842.]

Lond. Journ. Arts & Scien.

BIBLIOGRAPHICAL NOTICE.

The Encyclopædia of Chemistry, Theoretical and Practical. By James C. Booth, and Martin H. Boye; 8 mo.: Carey & Hart, Philadelphia.

Of the work under the above title, which is to be published in monthly parts, at twenty-five cents each, three numbers have been issued; and these have fully sustained the reputation of the gentlemen who are the editors, or, it might be more just to say, the authors, of the work. Those persons, acquainted with chemistry, who have been in the habit of examining the communications of Messrs. Booth and Boyé, as they have appeared in this journal and elsewhere, can-

not doubt their capacity to furnish a work of the kind under publication, which shall be equally and eminently useful, both to the student of chemistry, and to the professional chemist. That they have determined to justify the anticipations which their prospectus has created, is abundantly manifest from the contents of the part already published. From the rapid progress which chemistry has made within a few years, more especially in its application to the organic kingdoms, its language has necessarily become much more copious than formerly, and there is not any one work extant which can be satisfactorily employed as a book of reference, in which that language is explained, and in which the new theories that have been promulgated on the basis of the new facts discovered, are clearly presented. The work in hand will completely supply this desideratum; whilst, judging from the manner in which the articles before us are treated, every number as it appears, will be heartily welcomed by its readers.

In this age of cheap publications, when so much paper is spoiled by covering it with matter that is more than worthless, we have still the gratification of seeing many valuable works more widely diffused than was possible under the former systems; and that such will be the case with the "Encyclopædia of Chemistry," we most confidently believe, as it will be needed by every student and cultivator of a science, the value of which is being daily more fully appreciated.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Mr. Mallet's Paper on Water-Wheels.

The writer of the communication in the last September number of this journal, which is complained of by Mr. Mallet, in the following letter addressed to the editor of the "London Mining Journal," of December 23rd, 1843, requests the insertion of that letter; since he would certainly be the last to do *intentional* injustice to the well earned reputation, as an experimental philosopher, which duly belongs to Mr. Mallet; and he, therefore, regrets having been misled by the abstract of Mr. Mallet's experiments on water-wheels, which alone has yet reached America, and which certainly afforded ground for the remarks made by the writer in the September number:—

"*To the Editor of the Mining Journal.*

"*Sir*,—A paragraph appeared in your journal of the 11th of November last, stated to be copied from the "Journal of the Franklin Institute," which demands that I should beg to be permitted to trespass, in a few words, upon your columns in reply. Had the writer (who appears to be an American, and possessed of the usual share of conceit as to whatever is done at his side of the Atlantic,) examined my paper on water-wheels at length, in place of an abstract, he would have seen that no pretension is set up by me to be the originator of the 'circular conduit,' applied to overshot wheels, or even the first to determine the value of the application. The primary object of my

researches was to determine certain questions which (as far as I am informed,) the Franklin Institute *did not* determine, or meddle with; and the experiments made with respect to the use of the circular conduit, or 'close breast,' as the writer calls it, applied to the lower quadrant of overshot wheels, had special reference to the relations of my principal object, while the valuation of power was only a collateral conclusion. It is consolatory, however, to find how very close my results on this point come to those given by the Franklin Institute, although I did use 'insignificant models;' and it is worthy of observation, that the Franklin Institute has added nothing important to our knowledge, beyond what the experiments of our great Smeaton, on *his* 'insignificant models,' gave long ago. From well made and comparatively large models, better results can generally be got, when the differences of condition are properly attended to and estimated, than from observations on the great scale.

"I do not wish to be understood as depreciating the American experiments, which are really valuable, and made with great devotion of time and expense—but they neither discovered *everything* relating to water-wheels, nor set aside Smeaton's, and many others' results. My present object, however, is only to request, that by your insertion of these lines in the *Mining Journal*, you will do me the justice thus to contradict the heading to your quotation, in which you parade, in large letters, "Mr. Mallet's Close Breast for an Overshot Wheel not New;" you are yourself the first person who has called the close breast "Mr. Mallet's," and Mr. Mallet himself never claimed it, either as new, or for himself in any form—on the contrary, my paper alludes to it distinctly as an old invention.

"As to whether my researches on water-wheels are valuable or not, I am content to rest upon the opinions of some of the most distinguished of my professional brethren, as expressed in my having been honored with the premium of the Institution of Civil Engineers, for the communication describing them to that body.

ROBERT MALLET, Mem. Inst. C. E.

Dublin, December 15th, 1843."

There is, however, a paragraph in this letter which seems to require a passing remark, not for the purpose of exalting the experiments of the Franklin Institute beyond their real deserts, but for the sake of scientific truth. Mr. Mallet says, that the "Franklin Institute has added nothing important to our knowledge beyond the experiments of our great Smeaton," &c. Now it would be very easy to show that this Institute *has* extended our knowledge of water-wheels in several important particulars, beyond the conclusions of Smeaton. Two random examples, however, will suffice for the present.

1. Smeaton concluded that the overshot water-wheel realized *but sixty-six per cent.* of the theoretical power of the water. The Franklin Institute have shown, that when accurately constructed, "*eighty-four per cent. of the power expended, may be relied on for the effect.*"

2. Smeaton concluded, from his experiments, that "the best velocity (for an overshot wheel) is a little more than three feet" at the

skirt—though, singularly enough, he used a much higher speed in his practice, and yet never formally corrected the statements he had made before the Royal Society. The Franklin Institute have shown, that "the best velocity" ranges "*from four and a half to six and an eighth, and probably even to seven and a half feet per second.*"

Are these differences *nothing!* Will Mr. Mallet answer? And will he also say what questions he determined, by experiment, which the Franklin Institute "*did not?*" M.

Behavior of pure solutions of Sugar under different actions and circumstances; by CARL HOCHSTETTER. *Translated by* OEHLSCHLAGER, *and communicated to the Journal of the Franklin Institute by Wm. M. Davis.*

(Continued from page 56.)

Behavior of the Cane Sugar under the combined effect of the above mentioned influences, and under circumstances as they occur in the manufacture of Sugar.

The vegetable juices of the sugar manufacturers, both the cane and the beet juice, are, as is well known, ruined with lime. These juices then become alkaline, partly from an excess of calcareous earth, partly from caustic alkalies, which have been formed by the effect of the lime upon the acids.

I have shown above that lime and the alkalies, in general, do not decompose the pure sugar in its watery solution, not even under the co-operation of heat; the question is now, what is the effect of the lime when the solutions of sugar are mixed with foreign organized substances, and when the juices, as is often the case, contain already one or more other kinds of sugar before the treatment with lime? I have already partly described the behavior of the cane sugar, under such circumstances, in the last chapter. I have shown that the transformation of cane sugar, under the influence of nitrogenous substances, at a common temperature, are not prevented by lime, but are sometimes accelerated, or, at least, promoted. I shall now consider, at the same time, the effect of heat.

When fresh beet juice, which, by the test of copper, has been found free from every kind of sugar, except cane sugar, is treated with lime, as the sugar manufacturers do at a boiling heat, *one* of the effects produced, is that combinations of lime are precipitated, the component parts of which I have mentioned in the beginning; and a *second*, that a part of the nitrogenous substances undergo, at the same time, a decomposition of which ammonia is a product. If we examine the clear juice after this, we do not find a trace of any other kind of sugar; the cane sugar has not altered, nor has the clear juice become much darker: it is of the color of a light white wine. When this juice is boiled for an hour, or longer, in an open bowl, or alembic, and evaporated, ammonia is constantly generated, whilst the liquid becomes troubled, without getting much darker than what may be attributed

to the concentration of the liquid. When we apply the test by copper, we find as yet no trace of altered sugar, supposing that the juice has remained alkaline all this time. At the same time precipitates, consisting of carbonate of lime, leucine, and of another insoluble salt of lime, have been formed.

As very small quantities had been obtained (of these precipitates) in the experiments made on a small scale, and as a more intimate acquaintance with the resulting products from alkaline beet juice, formed during the process of evaporation, could not fail to be interesting, I examined the precipitates which are constantly forming in the evaporating boilers of the sugar house of Messrs. Schmidt & Co., in Wetterhausen, near Magdeburg, and found them composed of *leucine; carbonate of lime; two salts of lime*, the one of which could be decomposed by acetic acid, the other by muriatic acid; the acids of these salts were of an organic nature, but I could not determine them; a black substance resembling *humus*, which, on being heated, swelled, melted, and smelt like burned horn; *a lime soap*, the fatty acid of which is produced by the fat which is used during evaporation.

Besides these products, also soluble salts of lime are formed, and in the juice which has undergone evaporation, we find a number of foreign organic substances changed, more or less, by the influence of the heat and the alkali.

The decomposition of the substances containing nitrogen, which I supposed, in the beginning, is completely corroborated by the precipitates in the boilers for evaporation, for leucine is formed by the action of the alkali on these substances, and in the formation of this product, ammonia must be generated. Whilst these effects and decompositions continue, the sugar undergoes no change, the reason of which is, without doubt, that as soon as any acid products are formed, (the formation of these products we must take for granted,) they are immediately absorbed by the alkali, lime, and that we cannot expect any chemical action upon the sugar from the remaining part of the products of decomposition.

To produce these phenomena, heat of an intensity greater than the temperature of boiling water, or, at least, equal to it, is absolutely necessary; for when alkaline beet juice is evaporated in a vacuum at a temperature of from 70° to 80° C., almost no precipitates appear, which might indicate a process like the above. The bright copper heating plates remain bright, for no insoluble salts of lime have been precipitated. The different behavior of the alkaline beet juice in the vacuum boilers, and in the open boilers, cannot be attributed to the influence of the air, for the formation of steam, under evaporation, is so energetic, that a contact between the air and the liquid is out of the question.

I said before that on making my experiments on a small scale, no other kind of sugar had formed under such influences, that, in general, I could not discover any decomposition of sugar, which shows that in this case also the alkalies, the calcareous earth, exercise a protecting influence over the cane sugar. I had not an opportunity of

examining these facts on a large scale, and before that time I was unacquainted with the test by copper.

The phenomena are different when, as it is often the case, the beet juice has undergone some change before it is treated with lime, particularly when it contains fruit and grape sugar.

These two kinds of sugar manifest a behavior completely different from that of the cane sugar, when acted upon by alkalies. When these sugars are dissolved in water, and mixed with lime water, or the milk of lime, they undergo a complete decomposition, even at a common temperature, but a lasting effect is required. When acted upon by heat, these changes proceed very rapidly, and the more energetically the higher the temperature to which the alkaline solutions of these sugars are exposed.* The products which are formed have not been much examined hitherto; among others, several acids, glacic and melassic acids. The products of decomposition seem to resemble those which are formed by the concentrated action of acids upon cane sugar.

A solution of sugar which contains only the smallest portion of another kind of sugar, when heated with lime water becomes darker almost immediately. Lime water, or a solution of sugar in lime water, therefore presents to us a reagent (test) to discover another kind of sugar in a colorless solution of sugar. If a sufficient quantity of fruit, or grape, sugar be contained in an alkaline solution, the alkaline property disappears entirely after a short time, and more calcareous earth can be precipitated by means of carbonic acid.

On mixing the solution of a quantity of grape and fruit sugar with a concentrated solution of sugar in lime, and obtaining a liquid of about 20° B., not a trace of the foreign sugar could be discovered after two hours; they had been completely decomposed. The cane sugar of the sugar lime had remained unaltered during this process, that is to say, as long as there remained still some free alkali. The fluid in the mean time changed to a dark brown color, and precipitates had formed. When the quantity of the alkali is small, the action is not so intense.

I now revert to the beet juice, supposing that besides the cane sugar there are other sugars before the treatment with lime commences. In this case a very different phenomenon appears, from those observed in the good, pure juice of the cane sugar; the clear juice becomes colored, and, according to the state of the juice, assumes either a yellow, a bright yellow, or a reddish yellow color. The calcareous earth, and the other free alkalies, have immediately exercised their influence over the other sugar, and the result is the same as when a colorless solution of cane sugars is changed by the action of nitrogenous substances under the influence of the air, and at a common temperature. When the quantity of foreign sugar is large, the effect of the alkalies will continue during the process of evaporation, and as long as there is any free alkali and sugars, which can be decomposed by these substances.

* See Péligot's Inquiries into the Chemical Properties of different Sugars; Annals de Chimie, vol. vii. p. 113.

This is the reason why bad juices, although strongly alkaline, entirely lose their alkaline properties during the evaporation. This effect, it is true, cannot be entirely accounted for by the pressure of foreign sugars, but part of it must be attributed to the larger quantities of materials containing nitrogen, not to be separated by boiling, nor by the use of lime, and which are always found in greater quantities in bad, or altered, beet juice, than in unaltered beet juice; these, in their process of decomposition, absorb a part of the alkali. Beet juice strongly alkaline, will, by the test of sugar, indicate no other kinds of sugar, because they have been destroyed by the action of the alkalies.

I stated before that in unaltered alkaline beet juice no cane sugar is transformed, during evaporation, over a free fire. The copper test was not the only reason I had for this assertion, as, in this case, it might be deceptive, for, if another kind of sugar were formed during the boiling of the alkaline juice, it would be immediately destroyed by the action of the alkalies. If, however, in the above case, cane sugar had been transformed, such a change would have immediately manifested itself by a strong coloring of the liquid.

This aberration finally leads us to the conclusion, that in the beet juice, and, undoubtedly also in cane juice, which, before being treated with lime, contained no other but cane sugar, during evaporation, even over a free fire, and a temperature above that of boiling water, no cane sugar is decomposed; supposing that the fluid remained always alkaline, and that the coloring matter of the evaporated juice is the result of the soluble decomposed products of the nitrogenous materials.

If, however, the beet juice, before the treatment with lime, contained other kinds of sugar, the evaporated juice will also absorb through the actions of the alkalies, the products of the decomposition of the sugars, but again without any cane sugar being transformed. These products are generally soluble in sugar juice, and contain much coloring matter.

The result of these inquiries indicates several agents under the influence of which an alteration can take place in the cane sugar during the manufacture, or which may cause a decrease in the yield of cane sugar. As a synopsis, I here condense this part of my labor under the following propositions:

1. A pure solution of sugar is changed through the influence of atmospheric air at a common temperature, and the more readily the more numerous the surfaces are which bring them in contact. This process is considerably heightened when the solution of sugar contains nitrogenous substances, such as they occur in the saccharine juices of the beet, and of the sugar cane. The change consists in the formation of a new kind of sugar, undoubtedly fruit sugar. The presence of substances containing nitrogen, produces a secondary change, the so called mucous fermentation, but under certain circumstances also a vinous and a milky fermentation may be the secondary result.

2. The decomposition of a pure solution of sugar in boiling, during a space of time equal to that of the boiling operation on a large scale

goes on imperceptibly, whilst the change is perceptible when the solutions contain nitrogenous substances, all the remaining circumstances being the same.

3. The alkalies (the calcareous earth) do not change the sugar in its watery solution, not even in a temperature as high as 120° C., (248° Fahr.) They protect the sugar against the action of the decomposed materials of the substances containing nitrogen at a higher temperature. Under certain circumstances alkalies can promote a transformation of the sugar, namely, when there are substances containing nitrogen at a temperature which favors the process of fermentation.

4. The nitrogenous substances contained in the beet are qualified to change the cane sugar, both at a common temperature, and at boiling heat; in the former case the same changes take place which have been mentioned in 1. In the second, new kinds of sugar, undoubtedly fruit and grape sugar, are formed by the decomposed products of these substances.

5. Most salts, particularly the alkaline chlorides and earths, impede the crystalization of the cane sugar, without producing decomposition, or change. The action seems to be purely mechanical, for the sugars unfit for crystalization, act in a similar manner.

6. The influence of acid substances, of every kind, for forming grape and fruit sugar in the solutions of cane sugar, according to circumstances, and in different proportions, I have not examined more closely, as this influence has probably been observed more accurately than any other.

III.—*Application.*

We have seen that many causes can effect the cane sugar during its preparation, and trials on a small scale alone are insufficient to know to which causes the greater part of the change which the manufacturer, to his sorrow, observes in the, so called, molasses, are to be attributed; since we know for certain that neither the sugar cane, nor the beet, contains any other than cane sugar, the formation of molasses can only be attributed to decompositions which the layer undergoes during its preparation. It is true the molasses (sirop) of the sugar refiners does not solely consist of transformed cane sugar; but it does so for the greatest part. They contain, besides salts, coloring matter, and other substances no further characterized, yet a considerable quantity of cane sugar.

Although it is impracticable, on a large scale, to obtain from the *sirop* more sugar capable of crystalization, it is possible, particularly with the molasses, or sirop, of the beet sugar manufacturers, by the use of much coal and spirits of wine, to extract still a large quantity of crystalized cane sugar from them: to obtain all the sugar, is, however, impossible. Soubeiran, by means of a polarization apparatus, has examined several kinds of molasses, (sirops) and has calculated that they contain of cane sugar about 50 per cent.* Ventzke has found still greater quantities, as much as 60 per cent. The whole

* After deducting the water which the molasses contains.

mass of sirop obtained in reality, can, therefore, not be considered as the products of decomposition, for, as I have shown before, small quantities of salt possess the quality of preventing the appearance of cane sugar in a crystalized form, and combined with it to form a sort of sirop. The same influence is exercised by the sugars which do not crystalize; several experiments have convinced me that this is the case.

Whether the sirop of the sugar house contain much, or little, cane sugar, it is a fact, that by common means it cannot be extracted in a crystalized form, and knowing that foreign kinds of sugar, the decomposed products of the cane sugar, make the latter unfit for crystalization, the question remains of equal importance, to which causes the decomposition of the cane sugar, during its preparation, ought to be properly attributed.

I have shown that cane sugar of an alkaline beet juice, which, during constant boiling, is allowed to evaporate over a free fire, does not change any more than during the, so called, process of clarifying. In these two operations, therefore, the influence of heat contributes in no way to the formation of new sugar. If we take it for granted that heat is one of the most injurious agents during the process of manufacture, it could only act whilst the sugar is being boiled down, and then decompose the cane sugar.

I have proved that solutions of sugar, at a temperature above that of boiling water, which contains nitrogenous substances, can be changed by indirect means. This is the case during the boiling down of the sugar, when it is without a protecting substance, such as lime, or other free alkalies. In the better arranged sugar houses they use vacuum boilers to boil down the sugar, both in the preparation of the beet sugar, and the refining; in these the temperature never reaches that of boiling water, and by this means the influence of the heat is considerably modified. Soubeiran has also shown that when sugar is boiled down in a vacuum, the saccharine juices do not perceptibly change, having found that the aqueous solution showed the same capacity of polarization, after the process of boiling down, as before. When the sugar is boiled down at a low temperature, as in a vacuum, it does not undergo any change in consequence of the heat.

I shall not attempt to decide whether, when the boiling down is effected, under the common pressure of the air by means of steam, or over a free fire, a large quantity of sugar is decomposed, but it has been found, on a large scale, that the difference in quantity and quality between sugar houses, which perform all their operations of boiling in a vacuum, and those which perform them carefully over an open fire, is very trifling.

It is not improbable that so much attention has been bestowed upon the apparatuses of boiling, under the supposition that the production of sirop was particularly owing to the influence of a high temperature. I think that the decomposition ought to be attributed to other causes.

According to the knowledge we possess of the manufacture of sugar in tropical countries, the juice of the sugar cane evinced a pecu-

liar liability to undergo fermentation when favored by a high temperature, so that we may suppose that a great part of the original cane sugar is already altered before the juice is subjected to any other operations. The appearance of the phenomena of fermentation is by no means necessary for the transformation of cane sugar, for the signs of fermentation always indicate a previous transformation of cane sugar into other kinds, either grape or fruit sugar.

The inferior cane sugars of the colonies continue to change during their long voyages; these changes must be considered as processes of fermentation; sometimes the cane sugars are sour, probably from milk acid, sometimes mucous, or gummy, products are formed, but a change always takes place.

When the cane sugar comes at last to our sugar houses, it is treated with the greatest precaution, and boiled in a vacuum, so that no cane sugar can be decomposed; a part of the sugar, in the form of sirop, again undergoes a change, in case the sirop remains for a long time on the floors of the sugar houses.

All those who have had an opportunity of observing the effect of certain substances containing nitrogen, upon concentrated, or diluted, solutions of sugars, must confess that the circumstances under which the colonies manufacture and ship their sugar, point out the effect of these substances as the principal cause of the changes of the sugar capable of crystalization.

The juice of our native saccharine material, the beet, would, undoubtedly, at the high temperature of the tropical climates, change still more rapidly and energetically, than the juice of the cane, because the beet contains a much larger quantity of substances producing fermentation. Fortunately our time of manufacturing is in the winter. We perceive, notwithstanding, that the juice of the beet changes as soon as it leaves the cells of the beet, and the more readily the higher the temperature of the pits, where they have been kept, and the higher that of the air are. In good sugar houses care is taken that no perceptible changes take place, that the juice becomes sour and mucous, but it often changes without these indications. The changes always depend upon the state of the beet: in the fall, when the beet is used immediately after the harvest, the temperature does not affect it perceptibly; as early as January and February, it is observed in all sugar houses, that as soon as a thaw commences, and the temperature rises, the yield is less, and of inferior quality, but as soon as the weather changes again to cold, more and better sugar is obtained from the same beet.

In beet which has commenced sprouting, no foreign sugar is found, no more than in beet which is fresh, and has not been sprouting, but we observe a change in the substances containing nitrogen, upon which depends, in the spring, the more rapid change of the beet juice, even at a temperature only a few degrees above the freezing point.

As I have shown before, we are not able to separate, with lime, the whole of the substances containing nitrogen, from the juice, considerable quantities remain behind, and these quantities are in proportion to the changes which the juice has undergone; we know,

moreover, that all alkaline clarified beet juice, under the influence of the air, and other favorable circumstances, can change, and by a process of fermentation, can be entirely decomposed.

Whenever clarified, or evaporated, beet juice presents to the air large surfaces of contact, at a high temperature, and is allowed to stand for any length of time, moments which favor the transformations occur. This does not cease even when the sugar is in the mould, for the first sirops being left to themselves for some time the floors are undergoing constant, though slow, changes; the more the sirop is diluted, the more rapidly do these changes proceed.

At almost every period of the manufacture, we perceive the same causes of change which I have described under the influence of substances containing nitrogen, and, I think, that I can vouch for the correctness of the opinion, according to which the real decomposition of the cane sugar takes place alone under the influence of these substances, supposing that the operations, when no alkaline juices are boiled, are performed in a vacuum, and that whenever all the operations are carefully performed, upon a free fire, only the smallest part of the changes can be attributed to the elevation of the temperature. Another consideration might not be amiss here, namely, how far the method of preparing the sugar, the manipulations and apparatus hitherto in use, have answered their purposes.

The saccharine juice is extracted from the beet by two different methods, by expression and maceration of the fresh beet root, or by steeping the dried substances of the beet.

The present improved mechanical utensils for expressing the juice of the beet, perform this operation so quickly, that a change seems almost incredible; but the juice becoming black, we see that a change can occur. This change has, as experience teaches us, no evil consequences; it is, on the contrary, considered as a sign of the goodness of the juice, but it proves at the same time how quickly such a transformation is effected. In most sugar houses single masses of juice are allowed to stand for hours in the reservoirs, if a careful separation of the masses of juice which are extracted at different periods, is not attended to, because no preparation to this effect has been made in the construction. On the sides of the reservoirs, and of the other utensils, thin layers remain exposed to the air for a long time; they change, and mixing with fresh juice, cause a considerable transformation. The partitions and press cloths are the cause of still greater fermentation. To succeed, all these evils should be carefully avoided.

The adherers to the maceration system, mention as a principal advantage of their manner of proceeding, that in boiling the slices, or generally, the fresh mass of the beet, the albumen coagulates, whereby the fermenting properties are destroyed in the juice, and the cause of the failure, where the press is used, is removed. This, however, is a great error, which, all those who have ever attempted to extract sugar by this method, must have discovered.

By the boiling of the beet only a part of the substances containing nitrogen is precipitated, lime also effects only a part of it, as it forms in soluble combinations; a considerable part, and the very part which

is most likely to induce a transformation, is dissolved in the juice. It is true that the heat modifies the effect of these substances considerably, nay, for a time destroys it; but in a favorable temperature, and in contact with the air, they soon regain these properties.

The maceration of the beet, in the best maceration vessels, (tubs) requires six hours; an exact separation of the different masses of juice from every maceration, is, on a large scale, very difficult; wherefore some parts of the juice remain frequently a long time exposed to influences favorable to fermentation, change and finally involve the whole mass in a process of decomposition. These circumstances hitherto caused the failure of all the methods of macerations. The adding of lime during the process of maceration does not prevent a decomposition, it may, on the contrary, promote it. Very large quantities of lime can arrest it, but not unconditionally.

I have observed a lively fermentation in strongly alkaline juice; in the vessels for maceration, bubbles of carbonic acid arose, and lactic acid was formed. As long as the process of maceration cannot be performed in a very limited time, we cannot expect any favorable result from this method.

To separate these foreign substances, contained in the juice of the beet, at present only lime is used; this material, as I have shown, exercises no injurious influence, but it is insufficient, for it leaves a quantity of substances, the removal of which would be desirable, in a state of solution. Only under certain circumstances does it produce a pernicious effect upon the manufacture. This is the case when the beet juice, before being treated with lime, or before the process of evaporation, contains foreign sugars, for they become decomposed by the alkalies, and add to the quantity of foreign materials, some of which contain strongly coloring matter.

If, therefore, in the *one* case, great additions of lime only operate prejudicially, in as far as the calcareous earth must be removed before the boiling down, which requires either acids, a substance we do not like to make use of, or bone coal, which is expensive; large additions of lime, in the *second* case, moreover produce the injurious effect, that they decompose the foreign kinds of sugar contained in the juice, and, with the products, color the raw sugar, and deteriorate the molasses. In such cases it would be advisable, particularly during the process of evaporation, to keep the juice as little alkaline as possible; but, during the evaporation, to add gradually as much as is necessary to preserve the alkaline property in the juice.

I have shown that the cane sugar in the alkaline juice, during the evaporation at a common pressure of the atmosphere, does not undergo any change, that only the substances containing nitrogen are decomposed by the combined influence of heat, and of the alkalies, but without any pernicious effect upon the sugar, forming partly soluble, and partly insoluble compounds.

For this reason the evaporation of alkaline juice in a vacuum appears to me useless. According to my experience, when part of the same juice was evaporated to 25° B., in a vacuum, on a large scale, and part in an open evaporation boiler, the latter produced a better

result than the former, and this phenomenon was the more striking the worse the beet was, of which the juice had been evaporated. By means of my experiments and observations, on a small scale, I think that I can account for this.

When clarified beet juice is evaporated, in a vacuum boiler, at a temperature of 70 – 80° C., (158 – 176° Fahr.) precipitates which are scarcely perceptible are formed; they consist of fine, suspended flakes, evidently because the temperature was too low to decompose the foreign organic substances. Whatever alkalies and foreign organic substances the juice may contain at this temperature, no remarkable separations are formed. After evaporation, this juice, therefore, contains still all the foreign substances in a state of solution, a great part of which becomes separated at a higher temperature. The juice evaporated in open boilers, is, therefore, much purer than that which has been evaporated in a vacuum, and as in neither case foreign sugars are formed, or cane sugar is decomposed, the former must produce better results.

This also explains why, with inferior beet juice, the advantages of evaporation are still less apparent, for such juice contains generally a still greater quantity of foreign substances in a state of solution, which form isolated, sticky, and mucous materials, and become very detrimental to the crystalization of the sugar. Through the influence of heat and alkalies, these materials undergo a change when boiled under the common pressure of the air, and lose their sticky, and, at the same time, paste-like quality, without mentioning those decomposed products which are no longer in the sugar solution as insoluble. The advantages which are expected from performing all the operations of boiling in a rarified atmosphere, are, therefore, very illusive.

Those systems of evaporation where beet juice drops over warmed surfaces, (plates) and, by great contact with the air, loses its water, which evaporates, ought to be rejected altogether. The temperature in these systems of evaporation is generally too low to exclude the dissolving influence of the nitrogenous substances, and to avoid changing the sugar, although the juice contains alkali.

Systems of evaporations have also been introduced by which hot air is forced through the juices ready for evaporation, and by which means the evaporation of the water is effected. The economical advantages will not easily induce the manufacturerer to adopt this proceeding, although it is true that even here alkaline solutions of sugar will not easily undergo a change, taking it for granted that the temperature of the evaporating fluids approaches the boiling heat of water.

Contrary to a general opinion, I have always made the observations on a large scale, that when evaporation is effected at a temperature lower than 100° C., (212° Fahr.) the results are more greasy than those obtained by other systems of evaporation. To avoid being misunderstood, I should mention here that I am speaking of cases as they usually occur in the manufacture of sugar. Where excellent beet, containing very pure juice, is used, a smaller difference will be found in the products, in consequence of the application of different

methods of evaporation, unless they are altogether irrational, and the work is otherwise not properly directed, than where beet is used, the juice of which, on account of its many foreign substances, presents greater difficulty in the preparation.

When the saccharine juice is to be evaporated (inspissated) for crystalization, it ought to contain as few foreign substances as possible; they all prevent the forming of sugar crystals more or less, and, therefore, the excess of lime which commonly remains in the juice after evaporation ought to be removed. The application of sulphuric acid for this purpose requires much caution, and, besides this, not inconsiderable quantities of gypsum, are dissolved in the liquid; the animal coal is too costly a material for this purpose. In more recent times carbonic acid, extracted from coal by burning it, has been proposed and applied. As far as I know, the lime had been already precipitated in the saccharine juice before evaporation, wherefore it contained but little alkali, when this process commenced; as it appears, however, from all that I have already said on this subject, that alkaline properties in the juice are useful, the application of the carbonic acid appears only advantageous after the evaporation, if economical considerations do not prevent its use altogether.

The animal charcoal is the only means which has hitherto been employed, on a large scale, to brighten the color, and to remove the foreign organic, or inorganic, substances; and it would answer the purpose perfectly, if its high price did not put limits to its application. The removal of so many different foreign bodies from the juice without injury to the sugar, by any means, but that of absorption, similar to that of the coal, can scarcely be considered as practicable.

A cheap and easily procurable substitute for the animal charcoal now in use, would give a new impulse to the manufacture of beet sugar; if we could succeed in removing, by a simple and cheap process, the salts and organic substances with which the beet abounds, and which renders the preparation so difficult, being, in a great measure, the cause that the yield of crystalized cane sugar is so small, our inland manufacture would obtain a considerable preponderance over that of the tropical climates.

The juice ready to be boiled down for crystalization, can, in very few cases, contain alkaline properties, and in this process the higher temperatures, can, therefore, produce, upon the solutions of sugar, a greater effect than in all the operations which precede the boiling down; here, therefore, the application of vacuum boilers appears to be justifiable.

On Bleaching Salts. By M. Detmer, Esq.

A short time ago a notice was published, by M. Millon, on the Bleaching Salts of Chlorine, in which a new view was offered of the constitution of these compounds. They have for some time past generally been considered as compounds, or mixtures, of a metallic chloride with a hypochlorite of a metallic oxide; bleaching powder,

or the chloride of lime, for instance, as consisting of chloride of calcium, and hypochlorite of lime, in single equivalents, the acid of the last salt containing one atom of oxygen, to one atom of chlorine. The reaction of chlorine upon lime supposed, may be very simply stated: two atoms of lime take up two of chlorine; one atom only of the lime is decomposed, of which the calcium and oxygen respectively unite with an atom each of chlorine, forming chloride of calcium, and hypochlorous acid. The hypochlorous acid combines with the other atom of lime.

Starting from the composition of chlorochromic and chloro-sulphuric acids, which are represented by Walter and Regnault, as chromic and sulphuric acids in which the third proportion of oxygen is replaced by chlorine (CrO_2+Cl and SO_2+Cl,) Millon supposes that the bleaching chlorides have a similar relation to the peroxides of their metals. The peroxide of calcium being CaO_2, or $CaO+O$, bleaching powder is $CaO+Cl$, or the peroxide of calcium, with chlorine substituted for its second proportion of oxygen. In support of this view, Millon adduces observations of his own on the composition of the bleaching compounds of chlorine with different metallic oxides, such as oxides of lead, and protoxide of iron, as well as potash, soda, and lime, in which the proportion of chlorine was found to vary, but to correspond with the excess of oxygen, above one equivalent in the peroxides of the same metals. In particular, potash was found to absorb two equivalents of chlorine, and soda only one, the peroxide of potassium being $KO+2O$, while the peroxide of sodium is $NaO+O$.

The attention of the author was particularly directed to ascertain the accuracy of the latter statement. A solution of carbonate of soda was charged with chlorine gas, till it acquired a yellow color, and retained not a trace of carbonic acid. The solution was then briskly agitated with air, by which the excess of free chlorine escaped. In analyzing the solution afterwards, one portion of it was treated with a few drops of ammonia, and the chlorine afterwards precipitated by nitrate of silver; another portion was evaporated to dryness for the sodium, which was obtained in the state of chloride of sodium.

In four experiments the liquids charged with chlorine, contained chlorine and sodium in the following proportions, in 100 parts:—

Sodium,	47.88	45.26	46.81	44.76
Chlorine,	52.12	54.74	53.19	55.24

while, if the bleaching chloride of soda contained 1 eq. of chloride to 1 eq. of soda, its composition would be

1 eq. sodium,	46.91
1 eq. chlorine,	53.09
	100.00

The results correspond as closely as could be expected with this theoretical statement. There can be no doubt then that the chloride of soda contains one of chlorine to one of soda. This is the result required by Millon's theory, the peroxide of sodium containing, accord-

ing to him, one of oxygen, and one of soda; but it is equally consistent with Balard's theory, that the salt is a mixture of single equivalents of chloride of sodium, and hypochlorite of soda. To determine the quantity of chlorine which water dissolves, a stream of the gas was sent through water at 59° for five hours. One hundred grammes of water were found to take up 0.663 gramme of chlorine; or 200 cubic inches of water dissolved 207 cubic inches of gas. The chlorine was estimated by converting it into hydrochloric acid, by the addition of a few drops of ammonia, slightly acidulating afterwards by nitric acid, and precipitating by nitrate of silver. A solution of 2.58 chloride of potassium in 38.96, water was found to dissolve less chlorine than pure water, in the proportion of 180 to 257. Chlorine gas being allowed to stream through a solution of 9.245 grammes carbonate of potash in 96.495 grammes of water, till saturation, the solution lost all its carbonic acid, and took up 6.631 grammes of chlorine. Here 1 eq. of potash = 590 has taken up 656 chlorine, which is very nearly 1½ eq. of chlorine = 663. But when the quantity of free chlorine in the liquid is deducted, the latter is found to contain only 1.34 equivalents of chlorine to 1 eq. of potash. In two other experiments, in which the liquid was agitated with air after being saturated with chlorine, to allow the excess of gas to escape, there were found to 1 eq. of potash 1.44 and 1.43 equivalents of chlorine. The carbonate of potash, therefore, without doubt, takes up more than a single equivalent of chlorine. But the quantity of chlorine combined with the potash is still greatly short of two equivalents, the proportion required by M. Millon's theory; the peroxide of potassium containing two oxygen to one potash, or $K O_2$. The conclusion, therefore, is inadmissible, that the chloride of potash is analogous, in constitution, to the peroxide of potassium.

It remains to account for the property which potash is found to possess of taking up more chlorine than is necessary to convert it into chloride of potassium, and hypochlorite of potash. On transmitting chlorine through carbonate of potash, a stage in the absorption is very observable, at which the liquid becomes all at once of a yellow color. This happens when what remains of the potash is entirely converted into bicarbonate of potash. The suddenness of the appearance of the yellow color, appears to be due to a reaction of the carbonic acid upon the hypochlorite of potash in solution, by which hypochlorous acid is set free, and tinges the liquid. By the continued application of chlorine to the bicarbonate of potash, it is converted into a mixture of chloride of potassium, hypochlorite of potash, and free hypochlorous acid. By the ultimate action of the chlorine, all the bicarbonate of potash is decomposed, the carbonic acid entirely expelled, and a portion of hypochlorous acid remains free in solution.

This formation of free hypochlorous acid does not occur with carbonate of soda, owing to the much weaker affinity which that base has for carbonic acid, and its forming a much less stable bicarbonate than potash does. The free carbonic acid cannot, therefore, re-act upon the hydrochlorite of soda, and liberate hydrochlorous acid as the free carbonic acid does upon the hypochlorite of potash. The same

formation of free hypochlorous acid occurs in a more striking degree when chlorine is sent through a solution of acetate of potash; that solution, it is well known, absorbs a large quantity of gas, and acquires the strong yellow color, the odor, and all the other properties of free hypochlorous acid. It is here evident, that by the action of chlorine upon acetate of potash, chloride of potassium is formed, with the bin-acetate of potash, free hypochlorous acid, and the hypochlorite of potash. If the large absorption of chlorine, by carbonate of potash, is due to carbonic acid, it follows that caustic potash should not absorb any excess of chlorine, but that the property should be confined to the carbonate. Accordingly, in two experiments, the proportion of chlorine, absorbed by caustic potash, was found to be as nearly as possible a single equivalent. In one experiment 449.1 chlorine, in the other 424.8 chlorine were taken up, instead of 442.6 chlorine, by a single equivalent, or 589.9 of potash. Caustic potash, therefore, dissolves no more chlorine than caustic soda. There appears, therefore, to be no reason to abandon the old theory, that the bleaching solutions of chlorine in alkalies and alkaline earths, contain a chloride and hypochlorite, for these bleaching compounds certainly do not correspond with metallic peroxides, as has been lately maintained.

Mem. Chem. Soc., Lond.

On some of the Substances contained in the Lichens employed for the preparations of Archil and Cudbear. By Edward Schunck, Esq., *Manchester.*

Our knowledge concerning that department of organic chemistry which embraces the coloring matters, and other principles nearly allied to them, is of the most imperfect kind. Though many other branches of organic chemistry have been so thoroughly and accurately investigated, that little or nothing remains to be known concerning them, this may be called an unexplored field. Most of the coloring matters are so little known, as regards even their most essential characters, as not to allow us either to justify, or to question, the propriety of throwing them together into one general class; a class distinguished from those nearly allied to it merely by the (as far as we know) adventitious circumstance of the substances belonging to it, being endowed with certain more or less vivid colors. Among all the coloring matters, there are none, the study of whose properties and reactions is calculated to throw more light on the nature of the whole class, than those which are prepared by an artificial process from certain kinds of lichens, and on this account it is desirable that they should be carefully examined. It was the circumstance of these substances being prepared artificially from plants perfectly devoid of color, that first attracted to them the attention of chemists, and led to a series of investigations by which a number of highly interesting substances was brought to light, and a process elucidated which belongs to the most remarkable and unparalleled in the whole range of organic chemistry.

Robiquet first discovered a colorless crystalizable substance in them (orcin,) capable of being converted by the joint action of ammonia and oxygen into a true coloring matter, which contains neither the original substance, nor ammonia as such. This interesting discovery was followed by others. The researches of Heeren made us acquainted with a series of substances contained in the *Roccella tinctoria*, possessed of the same property, and another substance, phloridzin, was shown, by Stas, to bear a complete analogy to orcin, in this respect. The subsequent labors of Dumas, who subjected orcin, and the bodies derived from it, to an accurate examination, and of Kane, who has determined the composition of the substances discovered by Heeren, and of the coloring matters contained in archil and litmus, seemed to have sufficiently elucidated the subject. Some obscurities, however, in a part of Dr. Kane's late paper, seemed to make it desirable that some of his results should be confirmed before being finally adopted, and, at the suggestion of Professor Liebig, I undertook the reinvestigation of this subject, and performed it in his laboratory.

Instead of the *Roccella tinctoria*, I employed, in my experiments, the lichens that grow on the basalt rocks of the Vogelsberg, in Upper Hessia, where they are collected for the purpose of preparing a dye from them. These lichens were all crustaceous, and belonged to the genera *Lecanora*, *Urceolaria*, *Variolario*, &c. From them I extracted the following substances:—

1. A white, crystaline substance, soluble in alcohol and ether, but insoluble in water, bearing in its properties great resemblance to the substance called by Heeren *Erythrin*, and by Kane *Erythrilin*, but different in composition, and giving other products of decomposition. This substance I call *Lecanorin*.

2. A crystalizable substance identical in properties and composition with Heeren's *Pseuderythrin*, and Kane's *Erythrilin*.

3. A fatty substance of acid properties, soluble in alcohol, but insoluble in ether and water.

The method by which these substances were extracted, and separated from one another, was the following:—

The lichens were reduced to a coarse powder, and then treated with ether, in an apparatus of displacement, until the ether dissolved nothing more. The ethereal extract, which had acquired a green tinge from chlorophyl in solution, was distilled off, leaving as a residue a greenish yellow mass, consisting, for the greater part, of lecanorin. This mass was brought into a glass funnel, and washed with small quantities of ether, until it had lost its green color in part. It was then treated with boiling water, in order to remove every trace of pseuderythrin, and, lastly, purified by dissolving it in a small quantity of boiling alcohol, which deposited, on cooling, a snow-white crystaline mass, consisting of lacanorin in a state of purity. The dark green ethereal fluid obtained by washing the impure lecanorin, contained, besides lecanorin, the greatest part of the pseuderythrin which had been extracted by the ether. The fluid was evaporated to dryness, and the residual mass treated with boiling water, which deposited, on cooling, a mass of shining plates and needles of pseuderythrin,

which was purified by recrystalization. More of this substance was obtained by treating the lichens, which had been exhausted with ether, with boiling alcohol, and filtering rapidly. The alcohol was distilled off, and the residue treated with boiling water, which dissolved all the pseuderythrin, and deposited it on cooling. The mass left undissolved was washed with ether, which dissolved all the chlorophyl, and left behind the fatty substance mentioned above, which was purified by redissolving in alcohol.

I will now proceed to a more minute description of the properties of these several bodies.

Lecanorin.—This substance, when pure, is perfectly white. If prepared in the manner described above, it has the appearance of a white mass composed of acicular needles. When its solutions are slowly evaporated, it crystalizes in silky needles grouped together in star-shaped masses. It is insoluble in boiling water, but soluble easily in alcohol and ether. Its solutions redden litmus paper. It is soluble in alkaline liquors, from which it is precipitated unchanged by acids, provided the solutions be not boiled, and be not left to stand too long. It is insoluble in all weak acids, with the exception of acetic acid. Strong nitric acid converts it ultimately into oxalic acid. It combines with metallic oxides by double decomposition. Heated on platinum foil it melts, emits a dense vapor, and burns off, leaving but little carbonaceous residue. When heated in a tube closed at one end, it melts, and, under violent ebullition, gives off a dense vapor, which condenses in the upper part of the tube into a thick liquid, which, after some time, solidifies, forming a crystaline mass. The nature of this sublimate will be explained further on.

The action of the alkalies on this substance, is, of course, the most interesting point connected with its history. A solution of lecanorin in ammonia, when exposed to the air, acquires, after some time, a beautiful deep purple color: from this solution acids precipitate a red coloring matter. A solution in potash, under the same circumstances, becomes of a deep red color. Being desirous of ascertaining whether the lecanorin was immediately converted into the red coloring matter, or whether it passed first through any intermediate state, which was not improbable, I dissolved some of the substance in ammonia, excluding the solution from contact with the air. After a lapse of some hours, the solution, though perfectly colorless, was found no longer to contain any lecanorin; for acids, instead of producing a thick gelatinous, or flocculent, precipitate, as they do when applied immediately after solution has been effected, merely caused a brisk effervescence of carbonic acid, plainly showing that the substance had been completely decomposed without a coloring matter having been formed. The same effect was brought about instantaneously when the solution was boiled. In order to observe the process more clearly, I dissolved a quantity of lecanorin in baryta water in the cold. The solution, on being boiled, or allowed to stand, deposited a great mass of pure carbonate of baryta. The liquid was filtered rapidly, and the excess of caustic baryta precipitated by a stream of carbonic acid: on slow evaporation, it yielded large prismatic crystals of a substance which

possessed characters in every respect identical with those of *orcin*. It had an extremely sweet taste, was capable of being volatilized without change, and without leaving any residue; gave a deep blue color when dissolved in ammonia, and exposed to the air, struck a blood-red color with nitric acid, and precipitated a solution of basic acetate of lead. Lecanorin thus is converted, by the action of alkalies, into orcin and carbonic acid, in the first instance, this decomposition always preceding the formation of coloring matters. The same decomposition is produced by the carbonated alkalies, by long boiling with water, and by dry distillation, the heavy vapor, mentioned above as being produced by heating lecanorin to decomposition, being vapor of orcin.

The composition of lecanorin is expressed by the formula $C_{18} H_8 O_8$. The results of the combustions which I made of it, admit of no interpretation. All attempts to determine its atomic weight by means of combining it with metallic oxides, failed. These compounds can only be prepared by double decomposition; but the facility with which lecanorin is decomposed, when alkalies are added to its solutions, always renders the purity of the compounds formed liable to doubt. The compound with oxide of silver, formed by adding nitrate of silver to an alcoholic solution of lecanorin, and then precipitating by means of a few drops of ammonia, though it changed color but slightly in drying, gave no consistent results. The compound with oxide of lead, formed by precipitating a solution of lecanorin with basic acetate of lead, was so basic, and its formula so unusual, that I am led to suppose that one or two atoms of basic acetate of lead were precipitated together with it. By decomposing, however, a weighted quantity of lecanorin with caustic baryta, and determining the quantity of carbonate of baryta formed, I obtained very accurate results, confirming the formula $C_9 H_4 O_4$, or $C_{18} H_8 O_8$, for lecanorin. In regard to the composition of orcin, I have been induced to replace the generally received formula, for its composition, by a new one. Dumas' formula for anhydrous orcin is $C_{18} H_7 O_3$, and for crystalized orcin $C_{18} H_{12} O_8$, which evidently cannot be brought into accordance with the formula for lecanorin as given above. If, however, the formula $C_{16} H_6 O_2$, be taken for anhydrous orcin, and $C_{16} H_{11} O_7$ for crystalized orcin, then the decomposition which lecanorin undergoes with alkalies, may be expressed as follows:—

1 atom of anhydrous orcin,	$C_{16} H_6 O_2$
2 atoms of water,	$H_2 O_2$
2 atoms of carbonic acid,	$C_2 O_4$
1 atom of lecanorin,	$C_{18} H_8 O_8$

Two atoms of water are furnished by the decomposition of the lecanorin itself, and three more by the fluid, to form from $C_{16} H_6 O_2$ one atom of crystalized orcin, $C_{16} H_{11} O_7$. The combustions which I have made of this substance agree perfectly with these formulas, but Dumas' analyzes of the lead compound of orcin, which I have myself not yet examined, do not coincide with them, unless it be supposed

that this compound contains acetate of lead, either in chemical combination, or mechanically mixed.

In regard to the numerical results from which the above formulas have been deduced, I shall reserve them for a future occasion, when, having completed the investigation of the whole class of substances of which those here described are only a part, I shall be able to enter more minutely into details, and exhibit the facts and numbers brought to light in their proper connexion and order. I have merely been desirous of showing, on the present occasion, that our knowledge of this series of bodies is far from being complete. I have shown above, that the action of alkalies on lecanorin is two-fold; it consists, first, in abstracting from the substance carbonic acid, a process not requiring the co-operation of the oxygen of the atmosphere; secondly, in inducing, in contact with the air, the formation of coloring matters. The first action seems to have been overlooked in the case of all the bodies nearly allied to lecanorin. I have found the most complete analogy in the case of Heeren's pseuderythrin; and, if I am not mistaken in the interpretation of his statements, his erythrin also undergoes the same decomposition as lecanorin, for the former is converted into erythrin-bitter, by the very same agencies by which lecanorin is converted into orcin, and, in fact, there is the same relation in regard to all general properties between erythrin and erythrin-bitter, as between lecanorin and orcin. This circumstance is of some importance, for, in order to arrive at a knowledge of the exact composition of such complex bodies as the coloring matters formed by the action of alkalies on these substances, and to understand perfectly the nature of the process by which they are produced, it is absolutely necessary to know the exact substance out of which each is in the last instance formed, the last link of the chain which precedes its formation.

Pseuderythrin.—For this substance it would be advisable to substitute another name, as, in this case, the substance by which it is accompanied is not erythrin but lecanorin. It is contained in very small quantities in the lichens that I examined. It is sparingly soluble in cold water, but easily soluble in boiling water, from which it crystalizes, on cooling, in shining plates and needles. If more of the substance is taken than the boiling water can dissolve, the part left undissolved melts and collects at the bottom of the fluid in oily drops, which, on the temperature falling a little below 212°, congeal, and form crystaline masses. This is a characteristic property of pseuderythrin, and one distinctly mentioned by Heeren. It is easily soluble in alcohol and ether, and also in alkaline solutions. It gives compounds with metallic oxides by double decomposition. When dissolved in ammonia, and exposed to the air, it gives, like lecanorin, a red coloring matter; but its conversion into the latter is much more slowly effected than that of lecanorin. When subjected to dry distillation, it also gives a crystaline sublimate, accompanied by a copious disengagement of gas. When its solution in an alkali is boiled, or left to stand, some time, it imparts carbonic acid to the alkali, the decomposition being accomplished, however, with much more difficulty than with lecanorin. The exact nature of the substance left in solu-

tion, after this decomposition, I was unable to determine, on account of the very small quantity of pseuderythrin which I had at my disposal.

The combustions which I made of this substance confirmed the formula established by Liebig, at the time of Heeren's investigation, viz., $C_{20}\ H_{12}\ O_8$.

The *fatty substance* mentioned above, I have examined but slightly. It is soluble in alcohol, but insoluble in ether and water. From an alcoholic solution it is deposited in small pearly-white scales; if the solution be spontaneously evaporated, it is obtained in small, hard, shining, transparent crystals. It is soluble in alkalies, forming soapy solutions, and is reprecipitated by acids. Its alkaline solutions do not become colored when exposed to the air. It cannot be melted without being decomposed. Ibid.

Iron Founding.—From the Glasgow Practical Mechanic and Engineer's Magazine.

(Continued from Vol. VI. Page 275.)

Section III.—On Dry-Sand Moulding.

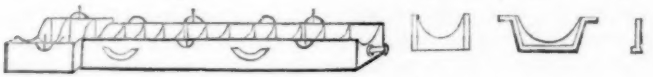
The next branch of the subject which falls under consideration, is the manufacture of works in dry sand, usually called dry-sand moulding. This department embraces, generally, the manufacture of pipes, columns, shafts, and other long bodies of a cylindrical form, or approaching to it. Dried, or baked sand, as was formerly stated, consists of loam called pit sand, that has already been used in structures of loam work, mixed with fresh sand. Dry sand acquires a very firm and open consistence by the expulsion of its humidity by heat, and it is found to be much better adapted to the purposes above mentioned than green sand.

The mechanical part of the process of moulding in dry sand, is the same as in the case of green sand work. In general, no coal powder is mixed with this sand. When the mouldings are finished they are transferred to drying stoves, in which they are exposed twelve hours, or upwards, as occasion requires, to the action of a strong heat till their humidity is banished. The experience of the moulder must be his guide in so mixing the materials at his disposal, as to produce the most accurate form of mould when finished, which shall also be sufficiently porous. Such moulds permit a readier egress for the gases generated by the casting, than green sand; generally, also, the castings turned out are less vesicular, and smoother upon the surface.

When the castings are large, and especially if they are tall, the hydrostatic pressure of the metal upon the sides of the mould is counteracted, both by the firmness of the sand, and by the wedge-shaped form of the boxes. To aid the resistance, the sides are feathered along the outside, affording additional abutting surface for the sand. Fig. 1, is a view of one half of a moulding box for pipes, the other half being an exact counterpart. Fig. 2, is a cross section, showing parallel sides. Fig. 3, is a similar section of a wedge-shaped box for

heavier castings. It is formed with flanches along the sides, which meet those of the other box. By means of these flanches the two halves are bound together by glands. Fig. 4, is a cross section of a flanched rib. A pair of swivels is attached to the ends of each box, by which they are raised and inverted as occasion requires. Another pair is usually fixed on the middle of the sides, upon which, when the boxes are hung, they may turn in a direction perpendicular to the preceding, that they may be set vertically at their destined position, which is commonly in a pit dug to receive them.

Fig. 1. Fig. 2. Fig. 3. Fig. 4.



Pipe moulds are always either set upright on one end, or laid in a position very considerably inclined, on a bed of sand prepared for the boxes, at an angle of 30° or 40°. When practicable, the larger sizes of pipe moulds are placed in a vertical position, as well as all other comparatively tall articles; the general object being to raise all the slag that collects on the surface of the iron, while being poured, clear of the cast into the gate-way, securing thereby soundness to the cast. It is evident that, were pipes, for example, cast horizontally, the metal, at any given period in the running, would expose a large horizontal surface, which is unfavorable to the soundness of the casting, and impurities besides would infallibly lodge in the upper portion of the mould. Both of these objections are removed by setting the mould in an inclined, or a vertical, position.

In proceeding to describe the method of forming moulds for pipe castings it will be necessary, in the first place, to describe the construction, and the formation of the cores. In the constructing of pipe moulds, as well as the moulds of all other large hollow articles, it is necessary that the core be both rigid and porous; these conditions are obviously necessary, when it is remembered that the least flexibility in the core must alter the thickness of the casting; besides, that the core, being itself so much confined externally by the liquid metal when poured, the ends alone serving as channels of escape for the interior air, must offer within itself facilities for the escape of the gases generated. Both of these objects are accomplished by employing a tube of iron, forming the centre of the core, and perforated at regular distances for the escape of the air. For the smallest sizes of cores common gas pipes are used with holes drilled in them at about nine inches distance on alternate sides. Wrought-iron tubes of a larger size are employed for larger pipes; and, for the largest sizes, cast-iron pipes are adopted with rows of oblong holes cut at equal distances for ventilation. These cast-iron *core-bars*—the general appellation to all the varieties enumerated—have wrought-iron double knees fitted and bolted to their extremities for the purpose of sustaining journals, or bearings, upon which they may be turned on their own axes. The hollow ends of the wrought-iron pipes are formed square to receive

a winch by which they also may be made to turn upon themselves, the use of which operation will speedily appear.

Again, a core-bar for a pipe of any given inside diameter is selected, two or three inches less in diameter, with the view of providing for hay-rope and loam, by which the core is made up to the necessary thickness. The loam, which forms the external coat of the core, is made as open as practicable by augmenting the usual proportion of sharp sand in its composition. The hay also, which is simply twisted into ropes to facilitate its application to the core, fulfils the important office of a conducting medium for the air forced through the loam, leading it from all parts of the surface to the vent holes in the core-bar. The method of applying the hay and the loam is simple. The core-bar is rested, by its pivots, on two iron tresses, the upper edges of which are formed with corresponding semi-circular, or triangular, dentations, to receive the pivots. Thus placed, the core-bar is caused to revolve by a crank-handle applied at one extremity, during which operation the rope is led on regularly along the bar from end to end, and fastened there. It must be tightly done, as any slackness in the rope will permit it to yield when subjected to the pressure of the iron, which has the effect, at least, of altering the form of the pipe, if, as in some cases, it do not break up the core, and spoil the casting. Before finishing the core with loam, the hay receives a slight coating of it all over, as a cement to smooth down the surface. This being dried, for the succeeding application of the loam, a loam-board is necessary. This is a board of sufficient length to rest upon the tresses which support the core. Along this board is laid the loam intended to form the core. The edge of the board is cut exactly to the form of the core, being, indeed, a half skeleton reversed. This board being then set along side the bar, and weighted down at the extremities, at a distance of the half diameter of the pipe from the centre, it is evident, that as the core-bar revolves, and the loam is pushed over upon it, there will ultimately be formed a coating of loam completely enveloping the coat of hay, which shall also possess the figure of the core.

Fig. 5.

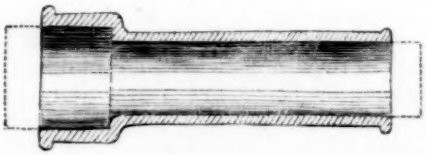


Fig. 6.

In this manner is the core formed. The annexed figures will illustrate the process. Fig. 5, is a longitudinal section of a pipe, in which

the exterior and interior outlines are represented. The dotted lines at each end indicate the additions necessary in the pattern as core-prints. Accordingly, fig. 6, represents the core as formed upon the bar before described, the core being prolonged to be supported in its bearings formed by the pattern, though it matters not if it should be longer than necessary. Fig. 7, represents the core-bar with its pivots at the ends, and the vent holes scattered over its surface. Fig. 8, shows the loam-board employed in constructing the core of the pipe, fig. 6. It will be observed to follow the outline of the core. Fig. 9, in like manner, represents the loam-board that would be required to form the pipe itself, fig. 5, were there no wood pattern of it. In such a case an additional coat of loam is run by means of it upon the core, fig. 6. In this way, it is evident, a loam pattern is at once formed.

Fig. 7.

Fig. 8.

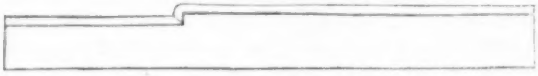


Fig. 9.

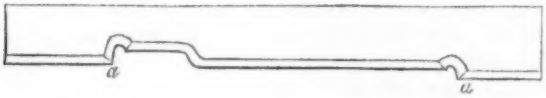
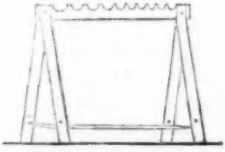


Fig. 10.

Fig. 11.



In setting the board, the parts *a*, *a*, (fig. 9,) will apply to the same parts, *a*, *a*, (fig. 6,) which, in so far, serve for a gauge. The misplacing of them exactly opposite each other, is to be guarded against, as there is not the same security for their being correctly placed. Before receiving, however, the additional thickness, the core must be washed over the surface with charcoal and water, that the thickness may be easily separable afterwards, and also thoroughly dried in the stove. In the mean time, having finished and dried the loam pattern, it receives, in like manner, a wash with charcoal water, and is ready to be moulded. This being done in the usual manner, the thickness is peeled off, and the naked core replaced in the mould. To aid the stiffness of the core, steeples are planted here and there over the surface of the mould, (as explained in the last article,) which resist any undue tendency of the core on one side, or another. Fig. 10, is a cross section of the body of the core. There are three concentric

pieces—the inmost, which is the core-bar, with several vent-holes in section, and the cross knee at the end; the next is the hay, and the external coat is the loam. Fig. 11, is a sketch of one of the iron tresses used in the work.

All wood patterns of pipes are constructed in two halves, which have two or more pins in the one entering corresponding recesses in the other, to prevent their shifting when put together and moulded. In proceeding to mould a pipe, a laying-down board is usually employed, which is simply a straight piece of wood as long and as wide as the moulding box. Upon this board one half of the pipe is laid with the flat side down, the box is placed over it, and rammed; the whole is inverted, and the board lifted off. The remaining half of the pipe is set upon the imbedded half, and the upper box over it, and linked to the under one; the upper box being rammed, the patterns are loosened, as we have in other parts described, and longitudinally also by blows upon the ends. The boxes being parted, the patterns removed, and the moulding black-washed with blackening, the core is set in, and the box closed. Small pipes, when there are several to be cast, are usually moulded in pairs in one box, when green sand is employed as a moulding material. The metal is poured in at one entrance, which branches to each moulding; shortly after which streams of aqueous vapor, mixed with hydrogen and other gases, arising from the imperfect combustion of the charcoal and hay, are expelled from the extremities of the core-bars, sometimes resolving themselves into luminous jets. Soon after the metal is poured, the castings are turned out to cool; after which the core-bars are drawn from them, which is a comparatively easy task, as the hay has been, for the most part, consumed, and, of course, occupies less bulk. Long small rods of iron are next introduced, with scrapers formed on the ends of them, and they are drawn from end to end, to clear the interior of the pipe of the remains of the core.

In the moulding of the various lengths of pipe that are required for use, one pattern is made to answer. Pipe patterns are generally made nine feet long, of which an appropriate number of lengths are cast, when more than nine feet of piping is required. But shorter lengths also are frequently wanted, when, of course, the full length of the pattern would not be proper. The moulding, therefore, is cut to the required length; in technical language, the pattern is cut in the sand. In such a case, some preparation is necessary to form a new bearing for the core. For this purpose two semi-circular pieces of wood, of the diameters of the mould, and the core, respectively, are sprigged together end to end, as in fig. 12; and it is obvious, that by placing the larger piece in the mould in each box, at corresponding parts, and ramming fresh sand about the smaller, the bearing will be formed. In like manner, if the piece of pipe terminate in a flanch the flanch having been moulded in its place, a half flanch of the same dimensions, with a half core print on it, as at fig. 13, is set into the mould, and the bearings for the core made up.

Fig. 12.

Fig. 13.

Small perpendicular branches required to be made upon pipes, are cast, either horizontally, or vertically, as may best suit the form of the box. In the latter case, the branch pattern is set loose upon the pipe, projecting upwards between the ribs of the box, and having been moulded, it is drawn out, and its core set in upon the pipe core, and the whole covered in.

Besides straight pipes, others have often to be cast of different forms, requiring peculiar treatment. In arrangements of pipe works, there is usually a number of knees, or bends, in their construction. These bends are usually cast separate from the straight portions of pipe, having facets upon them by which they may be afterwards joined to the pipes. The annexed, fig. 14, is a longitudinal section of a square knee in a line of pipes, showing the method of junction by spigot and facet. The term *spigot*, it may be as well to observe, is applied to the small semi-circular ring upon the plain end of a pipe, as may be seen in fig. 5; *facet* denominates the cup-mouth on the other end for receiving the spigot. There are usually patterns and core-boxes for pipe bends of the usual square-knee shape, in which case they are moulded in green sand. In the absence of patterns, however, for these, and for other varieties of short piping, they are *swept up* in loam, the core within the "thickness."

Fig. 14.

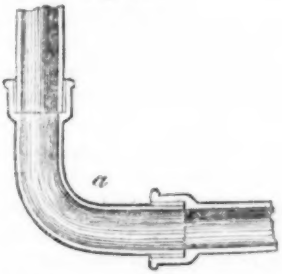
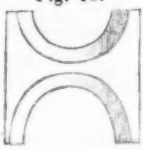


Fig. 15.



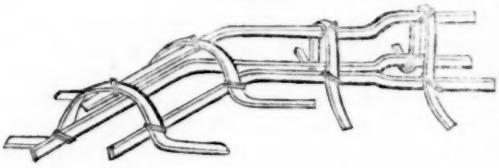
In this process, the first point is to have a level iron plate set, upon which the work is to be done. Like patterns, the loam work is formed in two halves. The cores are executed, in the first place, and, when dried, the thicknesses forming the exterior of the casting, are next laid on. Fig. 15, represents the gauge usually employed in forming small pipe work. As already said, the work is done in separate halves, for which purpose semi-circular cuts are made in the gauge, of which one is smaller than the other, being respectively the measures of the core, and of the additional thickness.

For example, suppose the bend, figured at sketch 14, is to be constructed, a small square rod of iron is bent to the form of the knee, against and along the side of which the gauge is moved. A quantity of loam being laid on the plate in the line of the pipe to be formed, the gauge in its progress fashioning the loam to its own form. When the two half cores are in this manner swept up, they are well dried and blackwashed, after which the gauge is inverted, and additional

loam being laid on for thickness, it is likewise shaped to the form of the pipe. The junction of the body of the pipe and the facet, which are of different diameters, and, of course, require different sweeps, is scraped out by a file when the loam is dried; the head on the end of the facet is either formed by a pattern applied to the moulding, or cut out of the *cope*.

The loam pattern being thus completed in two halves, dried, and blackened, it is bound together at two or three places by iron wire, and bedded half into a sufficient quantity of old loam mixed with water, and laid over the iron plate. The boundary of the loam is built up with fragments of cake loam. The bed being smoothed off on each side and dried, a layer of the same watered loam is applied to cover in the upper half of the pattern. As this upper layer has afterwards to be lifted whole, it requires to be strengthened by the addition of irons. With this view, pieces of rod iron, accommodated to the form of the moulding, are laid on among the wet loam transversely and longitudinally, and bound together by wires at the angles, constituting a kind of skeleton frame work, fig. 16, for the *cope*, as it is termed, or upper structure. The irons are then covered in with old loam, which is smoothed over them, and the whole is, for the last time, thoroughly dried.

Fig. 16.



The building of the work being now completed, the next step is to undo it to clear out the thickness. The cope is lifted off carefully, leaving the rest of the work behind it, and this complete separation of the parts is one object for which the blackening, or charcoal, water is applied. In the same way the pattern is lifted out from the bed of the moulding. The thickness is easily broken off the core, leaving the latter entire; the halves of which are next bound by wire, and replaced in the mould, stayed by bearings at the ends, and by steeples intermediately. The cope is replaced, guided to its former situation by intentional irregularities on the junction surface, and is bound by wires laying hold of the skeleton, to the under plate.

The gate is formed in the usual manner by a pin stuck in the cope while being formed.

Fig. 17.

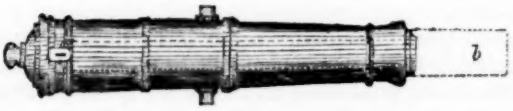
For some small pipes, such as bends which are uniformly circular, circular iron plates are frequently made to the same centre on both sides, so that when the cores are swept up on them, they lie concentric with each other. The edges of the plate will, therefore, serve for guides in the making of the core. For this purpose the gauges are made, as in fig. 17,

having a piece of wood nailed on, and projecting downwards. By sliding this gauge along the interior, or exterior, edge, as it may be adapted for them, the pipe is formed as before.

The manner of moulding and casting columns of every variety, and other long hollow work, is essentially the same as that now described for pipes; it is unnecessary to extend farther our details upon these articles. We shall conclude this section with a notice of the method of casting guns and carronades, taking, for example, a nine pounder gun, six and a half feet long, with a bore of 4.2 inches in diameter.

Fig. 18, is a representation of a nine pounder gun. Patterns made of wood may be employed where there exists no great demand for castings for them; but in the prospect of extensive supplies being expected to be furnished, it is a much superior method to construct iron patterns, which, when turned and polished in the lathe, always preserve their figure, and, of course, always produce good uniform castings.

Fig. 18.



As it is desirable to have these iron patterns as light as possible, consistent with the straining to which they may be subjected, they are made hollow throughout. It is then the business of the moulder, in the first place, to form a hay-and-loam pattern in a manner similar to that in which pipe patterns of loam are made.

As it is of great importance to secure solidity to gun castings, they are made without bore, and with an additional length on the muzzle end, as indicated by the dotted lines, which, of course, is provided for in the pattern. When the mould is formed, and set on end in readiness for being cast, the metal is poured into it slowly at first, increasing in flow as the mould is filled to the top, which is left open. Into this additional portion then, all the sullage rises that is collected during the course of the pouring, leaving the body of the gun casting generally in a pure state. The moulding sand adheres very firmly to the casting, and requires to be knocked off by a hammer and chisel afterwards in the course of dressing.

In preparing for boring the gun, the head, or sullage piece, is, in the first place, cut off close by the muzzle of the gun. A proper face is thus prepared for starting the bore, which is cut out of the solid.

It will be observed, on examination of the drawing, that the sullage piece is less in diameter than the rest of the casting. Formerly, lumps of metal of almost double the diameter of the muzzle were cast upon the end, in the belief that the exposure of such a considerable surface would draw up the sullage more readily to the upper part. This mode, notwithstanding the alleged advantages, defeated its own end; for it is easy to see that the body of the gun is opposed, by its taper, to the large head, being connected by the comparatively small muz-

zle. Accordingly, in course of cooling, as the shrinkage which attends the cooling, proceeds, the neck, or muzzle, will be forcibly drawn between the extremities, and will assume, in consequence, a vesicular structure, which is fatal to the perfection of the bore, and the strength of the metal. This cause of imperfection in gun castings vanishes in the comparatively small size of head now adopted, as it offers no opposition to the natural law of contraction, in connexion with decrease of temperature, while it, at the same time, affords free scope for the ascent of the sullage.

Our next step is to enter upon the business of *loam moulding*.

On the Process of Printing Warps to produce fabrics termed "Clouded," or "Chiné." By G. T. Kemp, Esq.

The art of clouding silk has been practiced upwards of a century, but until lately was conducted in a very rude manner, and at a very considerable cost.

The technical term to "cloud," or, as in French, "chiner," denotes the partial coloring of the threads of silk, or other material, previously to their being woven, producing an irregular, speckled appearance, or assuming a more definite design at the will of the operator, but always characterized by a softened, shaded, or irregular outline.

In 1839 a process, then in active operation at Lyons, was introduced into this country by Mr. Kemp, which afterwards proved to be nearly identical with that described in Mr. Walon's patent, taken out in 1825. In 1840, and following years, the process was very generally applied to manufactures of broad silks, ribands, shawls, and other articles of silk, as also to mixed fabrics of cotton, linen, or wool.

The process is as follows:—The warp, or "cane," generally of white, is "turned on," and "twisted in," in the ordinary manner, for introduction to a common loom, provided with a harness of the width and richness of the work to be manufactured. The "porry," or surface of silk stretched, or exposed, in the loom, is then carefully "picked," or cleared, from rough, or hairy, threads, and other imperfections. A firm heading, or "tab," about two inches in width, is first woven, after which a small rod is introduced in the shed, for the purpose of attaching the warp to the "cloth beam." "Cross-strings," are then woven in, to enable the workmen to twist the warp in with facility after being printed. The weaver next proceeds to draw about 12 inches of the cane through the harness, and weaves a strip of plain cloth, containing about 60 shoots, in three-fourths of an inch. After winding about 12 inches of the warp on the cloth beam, he repeats the strip of plain cloth, continuing the process, picking, or clearing, the cane throughout, until the whole warp has been thus prepared, the end of which he secures with a firm heading, as at the beginning. The shoot best fitted to weave in the strips of plain cloth is Italian singles, 12 or 14 deniers in size, with the usual Arganzine spin. This silk should be boiled off, allowing, by its fineness, the

coloring matter to penetrate the warp in printing. If a fine and delicate pattern is required, the interval of 12 inches cannot be exceeded with safety; but when the pattern is large, and the outline irregular, a longer space may be left between the strips. The cloth-beam, which needs not be more than three inches in diameter, requires a ring, or flanch, of wood, or cast-iron, to be fixed at each end of the warp to support the sides when it begins to rise on the beam, or roll. The frequent introduction of a set of smooth laths strung together, and encompassing, or casing, the beam, and wound on with the warp, are found to answer the same purpose as the flanches. It is important here to remark, that the warping and turning-on should be performed in the best manner, and the picking, or clearing, the cane very carefully watched, as it is obvious that mending any threads *after* the printing, must inevitably mar the work.

The object of forming the temporary fabric, just described, is to keep the threads of the warp in their proper positions during the subsequent operations of printing, steaming, washing, drying, and weaving, so as to preserve the pattern when woven.

The cloth beam with the warp thereon being delivered to the printer, he affixes it in a frame, in which it is supported horizontally on its axis; he then draws off a sufficient length of the partially woven warp, which is passed over the printing table, at the end of which it is attached to two parallel lengths of tape, about fifteen yards long, which pass over a series of rollers to an empty beam, which may be termed the printer's beam, to which they are attached, and which is placed near to, and *above*, the cloth beam, so as to enable the printer, at the same time, to let off the necessary length of warp from the cloth beam, and wind a corresponding length on to the printer's beam, as the printing of the warp proceeds.

When extended over the table, the warp is printed with blocks in the ordinary manner, as used by calico printers, being kept close down to the surface of the table, by means of a roller at each end, under which the warp passes, and which rollers are capable of being raised, or depressed, as circumstances require. The printing table is covered with a blanket, surmounted with an oiled, or painted, cover, between which and the warp a piece of calico is spread, of which a fresh length must be substituted every time a table-length of the warp has been printed. The neglect of this would cause the superfluous color, received by the calico, to smear the warp.

Each table-length of warp, when printed, is liberated from the table by raising the movable rollers, and is then drawn by the tapes over the series of rollers to the printer's beam, on which it is wound. During this passage of about fifteen yards in length, as before stated, a sufficient opportunity is given for *drying* the coloring matter on the warp, so as to prevent any smearing, or marking off, when rolled on the printer's beam. To assist the drying a certain degree of artificial heat with good ventilation is maintained.

The warp, thus printed, is wound off the printer's beam, and formed into a large skain of from eight to ten feet in circumference, and next undergoes the operation of *steaming* to fix the coloring matter,

great care being taken to prevent any condensation of moisture on the silk.

It is then thoroughly washed in a stream of cold water, to remove the extraneous coloring matter, and also the *thickening* ingredients with which the color is mixed. During washing, the silk is protected by a covering of loose canvas in which it is sewn up.

After drying, which is most advantageously effected without artificial heat, if the weather is favorable, the warp is given to the weaver to be rewoven into the ultimate figured cloth required.

In winding the warp again on the weaver's beam, the ordinary means of spreading it, by passing it through a coarse reed, or wraithe, are inapplicable, on account of the strips of cloth which have been woven across it; the process, however, is readily effected by stretching these strips to their full extent by hand, and thus guiding it on to the beam, or roll. The weaver pursues the ordinary method of manufacturing the piece of goods, drawing out as he proceeds in weaving the weft which has been woven in, to form the small strips of cloth before mentioned. No subsequent finish, or dressing, is required, and the work is ready for sale when it leaves the loom.

Trans. Soc. Arts, Manuf. & Com.

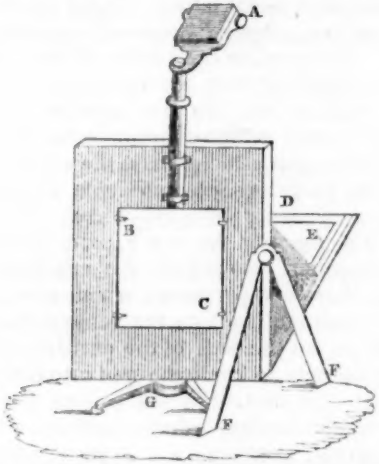
Smith's Prismatic Camera.

The Camera Lucida, though a very useful instrument, is open to this objection, that there is no image reflected upon the drawing paper; so that when any part of a sketch is left in an unfinished state, or the attention otherwise directed, it is next to impossible to commence again, so as to complete the drawing. To remedy this defect, Mr. Smith, the optician, has invented a very ingenious modification of the apparatus, which he calls the Prismatic Camera. It not only reflects on the paper a perfect outline of external objects, but preserves that outline without the least distortion, or alteration, of the portions for any length of time.

The construction of this improved camera is represented in the prefixed engraving.

In using the instrument, first open the stand G, always placing the widest of the three feet under the angular reflector, or silvered glass, D E, and the other two feet at the back. The reflector, D E, will find its own level, or position, when the machine is erect. Then steady the machine with the two wooden supports, F, and rule joint attached to the machine at the side. Adjust the prism A, to distinct vision, by sliding up or down in the tube. If a positive picture be required, it will be seen upon the slate, or semi-ground plate, of glass, B C. In this instance, the spectator should place himself between the object to be seen, and the machine, taking care that nothing intervenes between the prism A, and the object, always keeping the polished side of the square glass B C, towards the object. If a negative picture be required, the machine must be rendered opaque, by fixing with the four buttons the drawing papers. In this case, the spectator must sit with the machine before him.

Objects are seen to the best advantage when the machine is placed in a room with only one light, and that immediately opposite the machine. Should the picture, or reflected image, not be perfectly square upon the disk, this defect may be easily remedied by moving the machine, or the prism, (only) horizontally. By placing a print, or drawing, in an inverted position, and looking through the prism, it is seen erect, which answers all the purpose of the diagonal picture machine.



A, is a rectangular prismatic reflector; B C, a screen, or drawing board; D E, an angular reflector; F, the wooden supports; G, a tripedal stand.

Lond. Mech. Mag.

Mr. Defries' Dry Gas-Meter.

The description of this ingenious machine will be facilitated by comparing it with the double-acting steam engine, with which it is closely analogous, although the corresponding parts move with so little friction, that the trifling pressure of one or two pounds per square inch, thrown on the gas in the mains, is sufficient to move the entire apparatus; and the gas consumed is estimated by the number of movements of the expanding chambers of the meter, the cubical contents of which are known.

In the ordinary steam cylinder, with its slide-valve, the steam is admitted into the top of the cylinder during the time the steam at the bottom of the cylinder proceeds into the air, in high pressure engines, and into the condenser in those of lower pressure. When the slide-valve is moved, the conditions are reversed.

In Mr. Defries' dry gas-meter, the office of the cylinder is fulfilled by three rhomboidal cavities, each with a flexible diaphragm, which, by its bending, expands the one chamber, and contracts the other, in effect like the piston of the ordinary steam cylinder, and the meter is

provided with slide-valves and appropriate mechanism, which unites the three pairs of chambers into one system, so that the action is continuous and successive.

The external form of Mr. Defries' apparatus is that of a hexagonal prism placed on end; a horizontal diaphragm divides the hexagon into two principal parts, the lower and larger of which is subdivided into three rhomboidal compartments, meeting in the centre; each of these is bisected by a square, perpendicular, and *flexible* partition, formed of four triangular metal plates, hinged together at their edges by a skin of calf leather, properly prepared, somewhat as in the sides of organ-bellows. Attached to the centre of each flexible partition is a parallel motion, connected with a perpendicular shaft, which passes through a proper stuffing-box into the superior chamber, where the shaft terminates in an arm which communicates with a central crank; and as there are three such attachments, the expansion and contraction of the moving partitions communicate a rotary motion to the crank, without the necessity of a fly-wheel. Connected with the crank are three rods, moving the three pairs of slide-valves placed on an annular chamber, into which the gas first enters; the slide-valves lead it *into* those compartments which are expanding, and *out of* those which are contracting, into the general reservoir.

The pressure of gas on one side of the partition causes the contents of its fellow compartment to be discharged into the common chamber above, from which the measured gas passes direct to the burner. Below the crank of the central spindle, and upon the central axis, is fixed an endless screw, working in a vertical cog-wheel, communicating by a horizontal spindle with the index-train of wheels, by which the number of cubic feet of gas consumed in a given time is registered on a dial fixed outside the meter.

Trans. Soc. Arts, &c.

On a Screw-Joint for Water-Pipes, &c. By Mr. A. M. Perkins.

The mode employed for joining wrought-iron gas-pipes is to cut a right hand screw upon each extremity of every pipe, and to have corresponding sockets screwed at both ends with right hand threads, so that a socket having been screwed on the first pipe, the overhanging part of the socket serves for the reception of the second pipe, and so on. But the pipes do not come into contact.

Mr. Perkins, in his apparatus for warming buildings by a circulation of warm water, employs a right hand screw on the one end, and a left hand screw on the other end, of every pipe, and uses sockets which are tapped with a right and left hand thread at their opposite extremities.

Those ends of the pipe which are cut right hand are left square, whereas, those ends cut left hand are each formed as the frustrum of a cone, in other words, they have sharp, or V formed, edges. Therefore, when the differently formed extremities of two neighboring pipes are held at rest by means of gas tongs, and the socket alone is turned round, the pipes simultaneously enter the socket, and ultimately forci-

bly meet, so that the sharp edge of the one pipe is indented into the flat surface of the adjoining. The joints thus produced have been found capable of sustaining every pressure to which they have been applied, and the pipes themselves endure, without bursting, an expansive force of 3000 lbs. on the square inch.

The same principle is applied to cast-iron pipes for water-mains, &c., the right and left hand screws being cast on each pipe, and the sockets are also cast in iron. In these cases a mill-board annular washer, soaked in oil, is placed between the flat ends of the two pipes, which are screwed together by the double nut, as in the former case.

Ibid.

A New Gas.

The "Censeur," of Lyons, states, that at one of the late sittings of the municipal council, a trial was made of a new portable gas, to which its inventor has given the name of "hydroluminous." The apparatus, says this journal, is very simple, and applicable to the smallest candlesticks, as well as to the largest and most splendid candelabra. The light it gives is very fine, and it is so portable that it can be carried about with the common hand candlestick.

Lond. Mech. Mag.

Silver Plating as practiced at Sheffield. By Mr. Potter, Jr.

Plating on copper was first introduced in the year 1742, by Mr. Thomas Bolsover, a member of the Corporation of Cutlers, at Sheffield, who, when repairing a knife-handle, composed partly of silver, and partly of copper, suddenly thought that it might be possible so to unite the two metals as to form a cheap substance, which, presenting an exterior of silver, might be used for the manufacture of several articles hitherto made entirely of that metal. It was not till about forty years after the introduction of Mr. Bolsover's plan, that the ornamented parts of plated articles, called mountings, were constructed of silver. This great improvement caused the manufacture of plated wares to become one of the staple trades of Sheffield.

There are two important features in the process of silver plating, the one a perfect adhesion of the two metals, the other a protection from wear of the prominent edges by friction.

The process of manufacturing plated articles may be described as follows:—

An ingot of copper being cast, and the surfaces carefully prepared by filing, so as to remove all blemishes, and a piece of silver, also having one surface perfectly cleaned, are tied together by means of iron wire. A paste of borax and water is then passed round the edges with a quill, and the mass being placed in a common air furnace, is heated to a proper temperature, which is ascertained by means of a small aperture in the door. As soon as the union of the two bodies is effected, which is known by the oozing of the metal when the fusion of the two metals has taken place, the bar is removed from

the furnace. The quality of the silver used in this process is what is termed standard, containing about 18 dwts. of copper, to the pound troy. The effect of this alloy is to render the articles harder, and, consequently, more durable.

The ingot being thus prepared, the next operation is to form it into sheets, which is effected by passing the bar several times through large cylindrical rollers, generally moved by steam power; the lamination which the silver undergoes, during the operation of rolling, shows the perfect union of the two metals.

The dies for forming the ornamental parts of plated articles, consist of blocks of steel, on the face of which the pattern of the ornament is accurately drawn, after which the dies are moderately heated in an open fire, and then placed upon a leathern sand-bag; the die-sinker then proceeds to cut out the ornaments with hammer and chisel. When sunk to the proper depth, the surface of the sinking is dressed off, and prepared for the ornaments to be stamped in.

The stamping machine, of which a small working model was exhibited, consists of a vertical frame of iron, the uprights of which are formed with grooves in which the hammer, or drop, slides. The foundation of this machine consists of a square stone, on the upper surface of which is fixed an iron anvil, to which the uprights are firmly attached. The hammer is raised by a rope passing over a pulley fixed in the head-piece of the frame. The die is placed on the anvil immediately under the hammer, and kept in its proper position by screws. A luting of oil and clay is placed round the edge of the sink of the die, and melted lead is then poured into the cavity. When cool, the hammer is allowed to fall upon the lead, to which it firmly adheres by means of a plate roughed as a rasp, which is called the *lick-up*.

The silver used for the purpose of the mountings is also of standard quality, and is rolled to the required thickness; several pieces of the requisite size are then placed between pieces of copper of the same substance, and put upon the face of the die. The hammer is then raised, and allowed to fall gently upon them. This operation is continued for some time, gradually increasing the fall of the hammer, and diminishing the number of pieces struck, until they are forced to the bottom of the die; it is necessary occasionally to anneal the mountings.

The mounts being struck, as described, are now filled with solder, consisting of tin and lead, and afterwards secured by wires to the article to be ornamented, the body being covered with a mixture of glue and whiting, to prevent the solder from staining the surface; they are then soldered on by means of a gas blow-pipe.

The article is next boiled in a solution of pearl-ash, or soda, and scoured with fine Calais sand. The mounts are polished by a lathe, as in the case of silver articles, with rotten-stone and oil, then cleaned with whiting, and finished with rouge; a scratch-brush of brass wire is used for deadening the parts required, and the plain surfaces are burnished with tools of blood-stone, or steel, soap and water being used in this operation, which is performed by women.

Trans. Soc. Arts, Manuf., & Com.

On Mr. Williams' method of manufacturing Patent Felted Cloth.

By J. Duncan, Esq.

The process of manufacturing cloth by felting alone, may be described as follows:—Supposing it to be required to make a carpet, 27 yards in length, and six quarters, or 54 inches wide, of coarse wool, and of stout substance. A carding engine, of the width of 80 inches, is, in this case, to be fed with about 45 pounds of wool. The wool having passed through, the card arrives at the last cylinder, from which the ordinary sliver is combed off, as usual, by the doffer. This sliver, which is very similar to a large and wide cobweb, is received upon an endless traveling web, also 80 inches wide, and about 37 yards in length, the carded wool overlaying it; and when the revolution, or journey, of 37 yards is accomplished, one sheet of sliver, 80 inches broad, is spread over the entire surface of the web; the operation having been repeated for about 20 times, or until the whole of the wool is thus combed, the layer, of 37 yards in length, and of about 20 slivers in thickness, forms what is called a bat of wool.

The bat is then cut, coiled on a roller, and carried to a machine, called the "Hardener," which consists of two, or more, pairs of rollers lying upon each other, and having perforated steam-pipes between them. The bat passes down between these rollers, being moved forward by their action, while the steam from the perforated pipes is driven into the wool, which is thereby heated and moistened at the same time; all the top rollers have a slight alternating motion, which rubs the bat slightly, and causes an entanglement of the fibre, and thus the felting commences. By the time the bat has passed once through these rollers it has become thinner, and of considerable texture and strength, from the locking together, and entanglement of the fibres; its second passage through the machine further improves its texture.

The next part of the process is to pass the hardened bat, or partly formed felt, through a machine, consisting of rollers in two tiers, each roller of the upper tier resting between two rollers of the under tier, the whole being immersed in a trough, or bath, of soap and water: and the upper rollers have the alternating motion already adverted to, as they first revolve—say an inch, and then retrogade half an inch, and so on.

The felt having been thus well pressed, and further advanced towards completion, may be said to be in a state comparable with that of woolen cloth made with threads by the loom in the ordinary way, and like it, it is carried to the fulling, or felting, mill, in which, after having been subjected to beating for eight hours, it becomes a firm cloth, and is ready for dyeing, or printing, as may be required, and, when tentered and pressed, is fit for the market. The felted cloth becomes reduced in the process to about two-thirds the size of the bale of wool, or from 37 yards long by 80 inches wide, to 27 yards long by 54 inches wide. Ibid.

Modes of determining the Velocity of the Piston of a Steam Engine at different points of the stroke.

At the last meeting of the British Association, Mr. J. Taylor described a contrivance for effecting this object, by Mr. A. Rous, who was formerly a working engineer in Cornwall. It consists of a half-second pendulum, having a pencil fixed upon it, and pointed against a card attached to the beam of the engine. By the motion of the engine, the card is moved perpendicularly, so that the pendulum being put in motion, the pencil marks upon it waved lines, which determine by their difference of width apart, the relative velocities of the piston at all its different points. They are wide apart when the piston moves quickly, and closer together as the velocity of the piston decreases, the distance between every two lines denoting the distance traveled through by the piston in half a second of time.

In connexion with this simple, ingenious, and efficient mode of attaining the end proposed, we may notice one of an opposite character which we find described and figured in the Tenth Annual Report of the Royal Polytechnic Society. It is the invention of the late Captain Richard Tregaskis, and was communicated to the Polytechnic Society in May, 1842. It consists essentially of a circular box, divided into a number of cells. This box is connected by a chain, with the beam of the engine, so that it (the box) shall perform a complete revolution for every stroke of the engine. This box is fitted into a frame, and directly over the cells are two* funnel-shaped caps, with a small hole in the bottom of each. These caps are filled with fine tin sand; and the quantity of the sand which will flow through the bottom orifices being determined, the apparatus may be applied to find the velocities of the piston in the following manner:—The sand funnels being adjusted, and the chain of the cell-box connected with the beam of the engine, as the box is turned horizontally on its centre at the rates of velocity corresponding with the varying velocities of the piston in the several parts of its stroke, each cell receives a portion of sand relatively proportionate to the velocity of that point. The quantities of sand in the cells being then carefully weighed, gives the velocity at all the corresponding points of the stroke.

This is illustrated in Mr. Fox's paper, by an account of two experiments with the instrument, by Captains Nance and Dunstan. Having ascertained, in the first place, that the funnel would discharge 17 grains of tin sand in a second, "the time-measurer" was connected with the engine, and so arranged that one of its divisions would pass under the funnel at every foot of the stroke of the piston in the cylinder. The quantity of sand discharged by one stroke of the engine, from the funnel, into each division, was then carefully weighed, and the thirds and fourths of time worked thus:—there being 5¾ in the first cell to find the corresponding time,

$$5\tfrac{3}{4} \text{ grains} \times 60 = 345, \text{ and } 345 \div 17 = 20'' \ 17'''.$$

* The report says *two*, and the drawings show *two* caps; we cannot, however, see reason why more than one is used. The contrivance appears to us to be quite clumsy enough in its best form, and two sand-caps only make bad worse.

In this way the time for every foot of stroke was computed, and is given in the following table:—

TRESAVEAN ENGINE. 12 feet stroke in the cylinder.				WEAL UNY ENGINE. 10 feet stroke.			
Feet.	Grains.	Time.		Feet.	Grains.	Time.	
1	5¾	20″	17‴	1	5½	19″	24‴
2	4	14	7	2	4	14	7
3	2¼	7	56	3	2	7	3
4	2¼	7	56	4	2	7	3
5	2¼	7	56	5	2	7	3
6	2¼	7	56	6	2	7	3
7	2½	8	49	7	2½	8	48
8	2¾	9	42	8	2¾	9	41
9	3¼	11	28	9	3	10	34
10	3½	12	21	10	8½	29	59
11	4½	15	53				
12	13	4	53				
	48¼	170	14		34½	120	45

It is hardly necessary to state that Captain Tregaskis' contrivance wants all the simplicity, accuracy, and convenience, which so markedly characterize that of Mr. Rous. It is, indeed, scarcely possible to imagine any modes of effecting the same end more opposite. That of Mr. Rous is not only ingenious, but we doubt not, will be found decidedly useful in conjunction with Watt's indicator; the other will, we are satisfied, never be again put in operation, unless it be by a novice who may wish to exercise himself in the niceties of manipulation.

Glasgow Mech. & Eng. Mag.

Wire Ropes.

This interesting species of cordage is fast superseding, in many situations, that formed of hemp.

Wire ropes were, more or less, used in the French navy so long as twenty years ago, and public attention being gradually directed to their utility, they were, about ten years since, introduced, to a very considerable extent, into the service of the mines in the interior of Germany, and since then their ascertained merits have rapidly worked their way forward into public confidence.

Soon after the passage of an act of Congress for the better regulation of steam navigation, which required, amongst other things, that metallic connections should be employed between the steering wheels and rudders of steamboats, several ingenious men turned their attention to the substitution of wire ropes, for the hempen cordage gener-

ally employed. A consequence of this was the manufacture of some very good wire cordage, or rope.

The methods of manufacture have been gradually improved until a wire rope is now made in which, without much impairing the initial strength of the wires, a degree of pliancy is retained amply sufficient for every practical object, and almost, if not quite, equal to that possessed by cordage of hemp laid up in the usual manner.

In England these wire ropes have recently been employed with the greatest success, in mine and railway use, and for the standing rigging of ships. They have received the public approbation of a large number of civil and mining engineers, amongst whom may be found some of the leading men, of these professions, in Great Britain.

The leading manufacturers of wire rope in England, at this time, are Messrs. Smith, and Newall, who have each procured patents for their respective processes. Wire ropes both flat and round, of Newall's manufacture, have been very highly approved, under various circumstances of use.

Thus, on the London and Blackwall Railway, *eleven miles* of this rope has been in constant use for two years. *Six miles* of wire rope on the Brandling Junction Railway, including an endless rope on an inclined plane 1000 yards long, is said to work very well. *Thirty-seven miles* of wire rope are in use upon the Durham and Sunderland Railway, and are stated by Mr. Blenkinsopp, the engineer, to have *treble* the duration of hemp ropes. On the Oldham incline of the Manchester and Leeds Railway, a wire rope has been working very satisfactorily for eighteen months. Upon the inclined planes of the Shrewsbury Canal, wire ropes have been at work for two years and a quarter, and Mr. Beech, the engineer, expresses his belief, *that they will last two years longer*, and he states, at the same time, that upon these planes the hemp ropes, formerly used, *never lasted more than two years*, whilst their cost was double that of the wire rope, and their weight four times as great! At the Gosport colliery, near Newcastle, *two flat wire ropes* have been in daily use for four months, without indicating the least wear, their weight, in proportion to hemp, being as 21 cwt. to 47 cwt. Mr. Rœbling, a civil engineer in this State, has directed his attention to wire ropes; he has manufactured some very good ones, and has written some interesting articles upon the subject.

The Canal Commissioners of Pennsylvania having become aware of the importance of employing wire ropes in the internal improvement service, have put some of them in use upon the State works crossing the Allegheny range, and in their recent report we find the following paragraph:—

Wire and Hempen Ropes.—The ropes for the inclined planes and ferries on the line of our improvements, have hitherto been an enormous annual expense to the State. They are made of hemp, and, upon an average, it is believed that they do not last more than one season. There are ten required for the planes on the Allegheny Portage Railroad, one for the Schuylkill plane, one for the Millerstown ferry, and one for each of the slips for hauling out section boats at Columbia,

Hollidaysburg, and Johnstown. The average cost of each of these ropes is about $ 2,333.00, requiring an aggregate yearly expenditure of $ 35,000.00 merely for cordage to do the work upon the main line of our improvements.

It has been an object with the Canal Commissioners to reduce this heavy expense, if at all practicable. For that purpose they ordered a wire rope for plane No. 3, of the Allegheny Portage Railroad last year, which was used a considerable portion of last season, and the whole of the present year, and which seems to have been but little injured by use during that period. Wire ropes also, but of a lighter size, have been procured for the slips for hauling out section boats at Johnstown, Hollidaysburg, and Columbia, one of which has been in use for two seasons, the other two have done the work for one season. A wire rope for plane No. 10, of the Portage Railroad, has also been ordered, which has been manufactured and delivered at that plane, and which will be put on it in the spring.

So far as these wire ropes have been tested, they bid fair to answer the purpose; and, if the experiment shall ultimately prove successful, a large annual saving will be made to the Commonwealth by their substitution for hempen ropes. COM. PUB.

Sylvester's Process for Repelling Moisture from External Walls.

We find in a recent number of the "Civil Engineer and Architect's Journal," an abstract of a paper on this subject, read before the Royal Institute of British Architects, by Mr. Benjamin Ferrey.

This paper describes a very successful application of the process referred to. It seems that in a very exposed part of Dorsetshire, there is a brick school-house, which, though built with heavy walls, and *battened* inside, was almost untenantable during the driving rains which occur in that quarter, in consequence of the water penetrating through, and trickling down the wall in streams. To the exterior of this building, Mr. Sylvester's process was carefully applied as follows:

"A sufficient quantity was prepared, by mixture, in the proportion of three-fourths of a pound of mottled soap, to one gallon of water; this composition, when in a boiling state, was laid over the surface of the brickwork, steadily and carefully, with a large flat brush, so as not to form a froth, or lather, on the surface. This wash was permitted to remain twenty-four hours to become dry and hard. Another mixture was then made in these proportions:—one-half pound of alum to four gallons of water, which after standing twelve hours, in order that the alum should be completely dissolved, was then applied in like manner, with a flat brush, over the coating of soap."

These operations were performed during dry weather, in the month of July, and the middle of summer ought always to be selected for the purpose.

"Within a month after applying the above process, there happened one of those tremendous south-west gales, accompanied by a heavy

driving rain, such as had formerly drenched the school-house, and obliged the inmates to put pails, cloths, &c., to catch the drippings inside. It is satisfactory to state that the walls were completely proof against the rain; not a drop penetrated through during forty-eight hours of the most severe weather, nor from that time (the summer of 1842,) to the present, though repeatedly subjected to like trials, have the walls admitted the least moisture, nor has the artificial coating suffered, apparently, the slightest injury.

"The liquids, when applied, form a complete thin scale, or gummy-looking integument, perceptible only on close inspection, and the rain splashes against the walls as against glass, and runs down the face in a similar manner."

In addition to the above, a block of very porous and friable sand-stone, being wrought into a water-cistern, was well payed over, both outside and in, with Sylvester's composition, and then employed as a water-tank exposed to the open air, and all the vicissitudes of weather, *for three years, without receiving any injury*, though the particular stone used in this case, is notable for its inability to stand the weather without protection.

These facts—well authenticated as they are—induce us to request the particular attention of American builders to the very simple, and, apparently very useful, process of Mr. Sylvester.

Com. Pub.

Improvements in the Manufacture of Iron. By Thos. W. Booker, Esq., *of Melin Griffith, near Cardiff.*

The object of Mr. Booker's invention is to simplify and accelerate the conversion of cast-iron from its crude state into malleable, or wrought, iron, for which purpose the refinery, or furnace, is adapted to the various qualities, or descriptions, of cast, or pig, iron, which it may be necessary to use, by surrounding, or inclosing, the hearth with blocks of cast-iron, into, and through which, water is allowed to flow, or not, as may be expedient, and, as is well understood in making refinery furnaces, the blast of air being introduced through one, two, or more, apertures, or tuyeres, as usual.

The refinery is connected with the reverberatory, or puddling, furnace, which is constructed of the requisite form and dimensions. The bottom of the body of the furnace, and the grate bars, and binding plates and bars, are formed of iron: the other parts of the furnace are constructed with fire-bricks, sand-stone, or fire-clay, as is well understood. In the neck, or near the flue, of the reverberatory furnace, is an aperture through which the iron, when it has become decarburetted, or refined, in the refinery, is introduced, or run, in a fluid state direct from the refining hearth into the puddling, or reverberatory, furnace. On each side of which reverberatory furnace, a door is constructed; the door in the one side being immediately opposite to the door in the other, through which two doors the workmen perform the process of

puddling, in the ordinary way in which puddling is done, when working only with one door, which is the general practice.

As respects the refining.—Having thrown up the fuel, and having, by the application of fire and blast, produced the necessary heat, a charge of 9 cwt., or thereabouts, of pig, or cast, iron, of the description generally used for forge purposes, is thrown on and melted down, and decarburetted, or refined, in the ordinary way; and when the refining process is completed, the whole charge of metal is run off in a fluid state, direct into the reverberatory, or puddling, furnace previously prepared to receive it, by having been already heated to a proper degree of temperature, and by the bottom, sides, bridge, and opening to the flue, being protected in the ordinary way, by the workmen having previously thrown in a sufficient quantity of lime-stone and iron-cinder. The metal having been introduced into the reverberatory, or puddling, furnace in a fluid state, the workmen raise, apply, and regulate, and vary the heat in the ordinary way, by feeding and moving the fire in the grate, and raising, or lowering, the damper on the top of the stack, or flue, as circumstances require, and as is well understood; they, at the same time, stir and agitate the iron with bars and puddles, while the escape of the oxide of carbon, in a gaseous shape, takes place, and until the whole mass of iron agglutinates. The workmen then divide it into lumps, or balls, of a convenient size, and draw the charge from the furnace, passing the lumps to the squeezer, hammer, or rolling cylinders, or such other contrivance, or machinery, as is used for forging, or compressing, the iron.

During the process of refining the iron, by the application of heat and blast, in the open refining hearth, a considerable quantity of scoria, or cinder, is produced, which is tapped and run off as heretofore, as circumstances require; but it is to be observed, that during the process which the iron undergoes in the reverberatory, or puddling, furnace, the author does not find that any cinder need be generated, or produced, and cinders and lime-stones are thrown in, as already described, for the protection of the various parts of the furnace exposed to the action, or agitation, of the fluid metal, but no cinder need be tapped, or drawn off.

Mr. Aikin's opinion.—The principal novelty in Mr. Booker's invention, consists in placing the refining and the puddling furnace so near each other, that the refined iron may be run, in a liquid state, into the puddling furnace, instead of allowing it, as is usual, to cool, and become solid when let out of the refinery, previous to its being transferred to the puddling furnace. The heat lost by the iron is thus saved, as well as the time required to bring the solid, refined iron to a state of fusion.

If the quality of the iron produced by Mr. Booker's process, is not worse than that of iron refined and puddled in the usual method, Mr. B's. process deserves the approbation of the Society. But I would recommend that Sir J. Guest, or some other practical iron master, should be consulted.

Improved method of Bleaching Palm Oil. By CHARLES CAMERON, *Chemist.*

About six years ago a process for discharging the coloring matter of palm oil, was introduced into the soap manufactories here, which was as follows:—Into a strong cast-iron pan, built in the usual way, with a furnace below it, the manufacturers put two, or more, tons of oil, according to its capacity; they then, by means of the fire below, increased the temperature of the oil to 450°; the result was that the coloring matter was completely destroyed. But after working on it in the most careful manner, they were at last obliged to abandon it, for the following reasons:—

1st. By the time that the whole body of the oil was raised to 450°, the bottom of the boiler was heated to above 600°, and, consequently, the portion of oil in contact was decomposed, and, being converted into gas, frequently caused explosion to take place.

2nd. The effluvium from the decomposed portion was insufferable.

3rd. If not immediately run off, on the color being discharged, they frequently procured a black color, from the charred oil being mixed with the other.

The process was cheap, but from these reasons, and the danger attending it, they were obliged to relinquish it.

I have stated the above that you may the better understand the improvement I have effected in the process.

About four months ago I was induced to make some experiments to ascertain at what point of temperature the coloring matter began to give way, when I satisfactorily found that it began to change at 230°, and on continuing the process to within 2° or 3°, more or less, of that temperature, with *continued agitation*, it gradually lost its color, and at last became as white as home-made tallow, and of a hardness superior to any imported. I then fully established the fact, that a low temperature, (230°, instead of 450°,) length of time, and agitation, (agitation was not employed in the old process,) removed all the difficulties that prevented its former success.

The process which I recommend, and which is now acted upon here, may be thus described:—

A cast-iron pot is provided, containing from three to four tons of oil, with the ordinary furnace below it, and a horizontal, revolving fan of sheet-iron placed within it, for agitation, power being obtained from a steam engine with a speed of six revolutions per minute. In the absence of an engine, a wooden rake may be employed. The oil is then, by means of the fire, raised to a temperature of 230°; the fire is then withdrawn from below, and high pressure *steam* is introduced from a boiler, (15 lbs. pressure on the square inch of the valve) by means of leaden pipes, two, or more, according to the size of the boiler, of two inches diameter. By this means an equable temperature of 230° is obtained without any danger of decomposing the oil, and the process is continued until the color is completely gone. A vessel containing four tons will require ten hours to complete the

process, at an expense of only two or three cwt. of slack to each ton of oil.

It appears to me that the coloring matter is discharged by the absorption of oxygen from the atmosphere, as oil at a high temperature is known to have a strong affinity for oxygen at a high temperature, and hence agitation is essential, so as continually to present a new surface.

I inadvertently made it known, and although it is of great importance to the trade, I shall derive no benefit from it.

Ibid.

On Cutting Half-round, and other Curve-faced Files. By the late Sir John Robison, K.H., F.R.S.E., F.R.S.S.A.*

It is well known to workmen, that although it be an easy matter to get *flat-faced* files of almost any required degree of smoothness and regularity of surface, a *half-round* file having an approach to such smoothness, or regularity, is altogether unattainable at any cost.

A method having occurred to me of striking half-round, or even round, files with the same smoothness, and with nearly the same accuracy of figure, as the flat files, I beg leave to submit the process to the Society, that it may, through these means, become known to those to whom it may be of use.

To form a half-round file, either convex, or concave, I propose that blanks should be prepared as if for thin equaling-files, (*i.e.* of uniform thickness and breadth throughout,) and that they should be struck on one face, or both faces, of the degree of fineness required. This having been done, I propose that, by means of a screw-press, and swages of copper, or other soft metal, they should have the required degree of curvature impressed on them before being hardened, and that, in this manner, files with curved faces, but with the teeth of equable depth all across them, should be obtained.

In a similar manner I propose to form three-quarters round, or even cylindric, smooth files, by cutting flat blanks on one face, and then bending them on steel mandrils into a tubular form previous to hardening them.

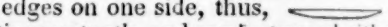
On communicating this plan to the eminent manufacturer, Mr. Stubbs, of Warrington, I learned from him that something of this kind had been attempted by his house, but abandoned on account of the difficulty experienced in getting the files into the curved shape after they were struck. Mr. Stubbs, at the same time, sent me a file so made, thirty years before. This file at once explained how the difficulty had arisen, as, instead of the blank having been made of uniform thickness and breadth, it has been fashioned like an ordinary crossing file, and, therefore, not susceptible of being squeezed into the regular curved shape by simple pressure. If Mr. Stubbs had thought of making the flat blank, he would, no doubt, have succeeded better;

* Read before the Royal Scottish Society of Arts, 12th December, 1842.

and the formation of tubular files, which he acknowledges never occurred to him, must have followed the other at a short interval.

Extract of a letter from Messrs. Johnson, Cammell & Co., Sheffield, to the late Sir John Robison, K.H., F.R.S.E., Nov. 7, 1843.

We now have the pleasure to hand you, as requested, an extract from our letter of Feb. 13th last, to the late Sir John Robison, explaining the mode we then adopted in the manufacture of the half-round files from steel of parallel thickness, as suggested by him, viz., by means of a screw-press, and swages of copper, and which we see is the plan named in the paper communicated to the Society.

From the specimens sent you last week, you will perceive we have deviated from the plan first suggested, "of cutting them from blanks of steel prepared as for a thin equaling-file." We, however, did not give up this plan until, from practical experience, we found its working very uncertain and irregular, for the file being of uniform thickness, the edges presented an equal, or greater, degree of resistance to pressure, than the centre; and the top swage, or boss, coming in contact with the centre of the file previous to any other part, caused it to bend more freely than the edges, producing various degrees of curvature in the same file. Again, if our top boss was so shaped as to create an earlier and freer pressure on the edges, to ensure a more uniform curve, we then endangered the sharpness of the teeth on those parts of each side of the file, convex and concave, first receiving such undue pressure. These objections and difficulties are all overcome, or lessened, by our present mode of cutting and turning the files from steel with slightly tapered edges on one side, thus, 
The flat surface is cut with a continuous tooth, and can be turned either convex or concave, and the tapered surface can either be cut in ridges, or left *safe*, or uncut, which, from the following extract, you will perceive, was Sir John's first idea. In Sir John Robison's first communication, November 10, 1842, after recounting the difficulty of obtaining a smooth half-round file, or one of equal continuous tooth, he says:—

"I propose to overcome this difficulty, and to cut half-round files as truly smooth as flat ones are now struck, by making the blanks of rolled steel-plate; by striking them in the flat state, and by afterwards giving them the degree of curvature required, by means of a screw-press, and tin, or copper, swages; or else by passing them between grooved and furrowed rolls (of soft metal for the *struck side*)," evidently implying that one side would be unstruck, or uncut. In fact, for some time, at first we only attempted to cut one side of the file, and frequently now we are requested to leave sometimes the concave, and others the convex surface, blank, or uncut.

Edin. New Philos. Journ.

Elkington's Process of Electro-Plating and Gilding. By Mr. Pellatt.

It is immaterial what metal is used for articles to be plated by this

process; a compound metal composed principally of nickel, however, is preferred, which, when plated with silver, can scarcely be distinguished from the solid metal.

The first thing before plating, or gilding, is thoroughly to cleanse the articles from all grease, or oxide, and this is done by boiling them in caustic alkali, and scouring them with sand and dilute acid; they are then washed and dried, and a copper wire being attached to them, they are placed in a metallic solution of the metal required to be deposited, the wire being connected with the negative pole, while a silver plate, suspended in the same solution, is connected with the positive pole of the battery.

The process of gilding is similar to that of silvering, except that the gold solution requires to be heated while the process is proceeding.

Great care is required in the arrangement of the batteries, the object being to decompose the solution easily, and at the same time to produce a firm, smooth, and regular deposit of the metal. The secret of the manipulation consists in the correct balance of power between the battery, on the one hand, and the strength of the solutions, and the number of articles to be deposited on, on the other.

The solution for gilding is prepared by dissolving the gold in a mixture of pure nitric and muriatic acids, the product being a chloride of gold; after evaporation, this is converted, by means of an alkali, into the oxide, which oxide is dissolved in pure cyanide of potassium.

The solution of silver is prepared by dissolving pure silver in nitric acid diluted with distilled water, and similarly treated with the cyanide of potassium, as in the gold solution.

In forming articles of solid silver, the following process is employed:—

Upon a wax model is first deposited a copper surface by the electro-process; the wax is then melted out, and thus a perfect mould of copper is obtained, into which is deposited silver of any substance that may be required. The copper is then removed by dissolving it with acid, and the article required is obtained.

If the original model is in metal, an elastic mould made of glue and treacle is used, by pouring the composition, in a liquid state, upon the model.

By a late improvement the proprietors have the means of giving a metallic conducting medium to this composition, and to other substances, without the use of any external application, as black lead, &c.

Trans. Soc. Arts, Manuf. and Com.

Substitute for a Transit Instrument.

A neat reflecting instrument called a Dissleidoscope, has been contrived by Mr. Dent, the well known chronometer maker, to be used instead of a transit instrument, for determining the time by the passage of the sun and stars over the meridian of any place.

Imagine a prism made of three plane glasses so fixed, that the plane of the upper one is at right angles to the plane of the meridian,

but the upper end declining in any angle towards the north. When the sun, or star, as it approaches the meridian, comes into the field of this instrument, its rays are reflected in a given angle, from the surface of the upper glass. This angle is sensibly the same during the time the object is transiting the field of the instrument, and the image of the object will appear to travel from east to west.

A portion of the sun's light passing through the upper glass, will fall on the glass forming the eastern side of the prism, and being reflected thereon to the glass forming the western side of the prism, will be by that sent up through the upper glass. The consequence is, there will be two images of the sun, one reflected from the upper glass, and the other by two reflections from the lower glass. The last image, as the object approaches the meridian, and middle of the instrument, will travel from west to east, or directly opposite to the first reflected image; and when the object is on the meridian, the two images will coincide.

The angle in which the lower glasses are inclined to each other on the lower angle of the prism, is not necessarily confined to any limits, but it should not be too acute. The angle, however, in which the axis of the prism is inclined to the horizon, should be such as never to have the ray at right angles to it, or to the surface of the upper glass, because if it was the head, it would be in the way of viewing the contact, or coincidence, of the two images.

By putting the axis of the instrument parallel to the horizon, Mr. Dent has also contrived to make it an instrument of equal altitudes, and thus, with the aid of a good watch and clock, to determine its own meridian.

Mr. Dent generally places the axis of his prism parallel to the axis of the earth, but if that axis is made to move about another at right angles to the plane of the meridian, the transit of stars below, as well as above, the pole, might be observed. He also has the face of the prism, not—as we have for the better exemplification of the *modus operandi* described it—perpendicular to the plane of the meridian, but declining from it towards the west in a small angle. By this means he avoids the interception of the rays by the head.

The rectification and verification of the instrument are likewise very easy, and its trifling expense (two guineas) and portability, will, doubtless, render it a favorite substitute for the more costly transit instrument. It is, of course, a patented invention.

Lond. Railway Journ.

Gilding and Silvering by Immersion.

The following new methods of gilding and silvering, by immersion, have been adopted on the Continent. Their easy execution puts them within the reach of persons who have hitherto been strangers to this kind of operation:—

Gilding on Silver.—Silver is gilt very readily by means of neutral chloride of gold, added to a solution of sulpho-cyanide of potassium,

till the precipitate formed at first is redissolved. It is necessary that this liquid should preserve a slightly acid reaction, and if it has lost it by too great an addition of sulpho-cyanide, it must be rendered so by adding a few drops of hydro-chloride acid. In order to gild, the silver is plunged into this liquid nearly boiling, and tolerably concentrated, in which state it is kept by pouring, from time to time, some hot water to replace that which has evaporated. In this manner, inconveniences which would result from too great concentration of the acid is avoided, whose pressure is, nevertheless, useful to oppose the formation of an auriferous precipitate which takes place by elevation of temperature, when alkali predominates.

To Gild and Silver on Copper, Brass, and Bronze.—The solution of the cyanide of gold, or silver, has been already pointed out for silvering and gilding under the influence of electric forces, but it has been found that the same solutions, brought to a temperature near their point of ebullition, can also gild and silver by dipping. With regard to their preparation, if it were necessary to obtain them chemically pure, it would be expensive, without any advantage being obtained; the operation can be simplified, and rendered much less expensive, by adding directly, either to the chloride of gold, or to the nitrate of silver, neutral, the cyanide of potassium in excess, so as to obtain the soluble double cyanides.

Silver cannot be gilt by this method, but as has been already stated, the sulpho-cyanide of gold and potassium gilds this metal very well.

The solution of the cyanide of copper in the cyanide of potassium, will not copper silver, even in contact with zinc; however, it will copper this latter metal in a very solid and perfect manner.

It must, however, be stated that these processes, though so very convenient, because they always succeed, and require but a few minutes for their preparation, deposit, unfortunately, but a very thin coating of the precipitated metal. This is an inconvenience common to all methods of coating by simple immersion.

Civ. Eng. & Arch. Journ.

Hullmandel's Lithotint Process. By B. Rotch, Esq., V. P.

From the time of Senefelder, who invented lithography, in 1796, up to the present day, this beautiful art has gone on gradually improving; but in no instance has so important a step been made as in that of Mr. Hullmandel's process of producing original drawings, or fac-simile copies as may be required. Previously to the lithotint process being introduced, crayons made of a composition of grease, wax, shellac, soap, and black, were used for a similar purpose.

Mr. Hullmandel's process, which is the result of numerous experiments, may be thus described:—The drawing having been sketched, tinted, and finished by the artist on stone, with lithographic ink mixed with water, to produce the various shades, which is as easily done as on paper, is covered over with gum-water, and weak nitric acid to fix it. After remaining a sufficient time to dry, a solution of rosin in

spirits of wine, is poured over the stone, and as this ground contracts by drying, it cracks into thousands of reticulations, which can only be discovered by the use of a microscope. Very strong acid is then poured over the aquatint coating, which, entering all the fissures, produces the same effect on the stone as the granulations of the chalk by the ordinary process. The rosin protects the drawing in every part except in the cracks. The acid having remained a sufficient time to act on the unprotected parts of the drawing, is removed, the ground is washed off, and all appearance of the subject on the stone vanishes, until ink being applied by a roller in the ordinary way, it is reproduced, and ready for taking off the required number of impressions, which, in some cases, have extended to the number of 2000.

Trans. Soc. Arts, Manuf. and Com.

Lunar Occultations.

Lunar Occultations visible in Philadelphia during the month of April, 1844; computed by Mrs. Charlotte S. Downes, from the Elements published with the Occultation list of the United States Almanac.

The Immersions and Emersions are for Philadelphia, mean astronomical time. Im. for Immersion, Em. for Emersion. These abbreviations in *Italics* refer to those Immersions and Emersions which take place on the Moon's dark limb. N. App. for Near Approach.

The angles are for *inverted image*, or as seen in an astronomical telescope, and reckoned from the Moon's North point and from its Vertex around through East, South, West, to North and Vertex again. For direct vision add 180°.

APRIL, 1844.

Day.	H'r.	Min.	Star's name.	Mag.	From North.	From Vertex.
5	17	1	Im. δ Scorpii,	3	27°	11°
5	17	31	*Em.*		342	311
19	21	9	Im. Mars,		32	87
19	21	58	Em.		299	354
20	6	13	*Im.* κ^1 Tauri,	5.6	32	337
20	6	48	Em.		334	278
20	6	2	*Im.* κ^2 Tauri,	6.7	62	5
20	7	3	Em.		304	249
20	7	59	*Im.* Bessel,	8	119	66
20	8	52	Em.		248	197
21	7	35	*Im.* n Tauri,	5.6	159	103
21	8	7	Em.		218	163
22	7	4	*Im.* Bessel,	8	104	50
22	8	15	Em		285	229
22	8	16	*Im.* Bessel,	9	147	91
22	9	2	Em.		241	186
22	8	21	*Im.* Bessel,	9	121	68
22	9	29	Em.		268	213
23	7	33	N. App. Bessel.	9	☽N.4'.5	
23	10	4	N. App. Bessel,	8	☽N.1'.9	
23	10	53	*Im.* Bessel,	9	83	31
23	11	42	Em.		310	262
23	11	23	*Im.* Bessel,	8	153	103
23	12	1	Em.		67	192
23	11	11	*Im.* Bessel,	9	99	48
23	12	5	Em.		294	247
24	9	50	*Im.* 972 Bailey,	7	100	47
24	10	42	Em.		304	251